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A FLORA OF CALIFORNIA

BY
WILLIS LINN JEPSON, Ph. D.

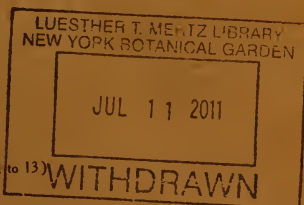
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ILLUSTRATED WITH MANY ORIGINAL FIGURES

PART I.

(Pages 33 to 64; figures 1 to 13)

PINACEAE TO TAXACEAE



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A FLORA OF CALIFORNIA

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ABBREVIATIONS

Bibliog.—General references to literature.

Refs.—Citations of species and of synonyms or critical discussions of these.

Locs.—Specific localities where the species has been collected.

Co.—County.

Acc.—According to

Var.—Variety.

F.—Forma.

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GYMNOSPERMS

Resinous trees or shrubs, ours evergreen with linear, awl-like or scale-like leaves. Trunk usually persisting through the crown as a single axis, increasing in diameter by an annual layer of wood inside the bark. Sexual reproductive organs consisting of stamens and ovules. Stamens generally spirally arranged in a catkin-like cluster which falls after maturity. Ovules commonly borne naked on the surface of a scale with the scales arranged spirally in a short catkin which commonly matures into a woody cone. Cotyledons several to many, sometimes only 2.

Bibliog.—Endlicher, Stephano, *Synopsis Coniferarum* (1847). Carriere, E. A., *Traite Coniferes* (1855). Engelmann, Geo., *Papers on Coniferae* (Collected Works, p. 326,—1887); Masters, M. T., *The genera of Taxaceae and Coniferae* (Jour. Linn. Soc. vol. 30, p. 1,—1893). Wordsell, W. C., *Structure of the Female Flower in Coniferae* (Ann. Bot. vol. 14, p. 39,—1900). Veitch, James, et al., *Manual of the Coniferae* (1900). Coulter & Chamberlain, *Morphology of Gymnosperms* (1901).

PINACEAE. PINE FAMILY.

Trees or shrubs, typically with one main mast-like axis which bears laterally successive whorls of much-branched limbs. Leaves narrowly linear and alternate, or with bundles of needle-like leaves in the axils of scale-like (primary) leaves. Stamens and ovules in different catkins on same tree. Staminate catkins with numerous spirally arranged stamens, each bearing 2 pollen-sacs and ending in a roundish crest or mere knob; pollen-grains usually with 2 bladder-like appendages to assist distribution by the wind. Ovulate catkins with spirally arranged scales, each subtended by a distinct bract; ovules naked, 2 at the base of each scale on the upper side, maturing into seeds which commonly bear a wing derived from the surface tissue of the scale. Fruit a woody cone, the scales much enlarged, the bracts remaining small or sometimes elongated and surpassing the scale.—Northern hemisphere, eight genera. California has endemic representatives of all the genera except *Cedrus* (Lebanon Cedar and varieties), *Larix* (Larch) and *Pseudolarix* (of China).

Bibliog.—Don, David, *Five New Species of the Genus Pinus* discovered by Dr. Coulter in California (Trans. Linn. Soc. vol. 17, p. 439,—1837). Lemmon, J. G., *Pines of the Pacific Slope* (2d Rep. Cal. Board For. p. 67,—1888); *Cone-bearers of California* (3rd Rep. l. c. p. 79,—1890). Sargent, C. S., *Silva N. Am.* vol. 11 (1897), vol. 12 (1898). Masters, M. T., *A General View of the Genus Pinus* (Jour. Linn. Soc. vol. 35, p. 560,—1904).

Cones pendent or spreading, falling from the tree whole, the scales persistent.

Leaves of 2 kinds, needle-leaves in fascicles of 1 to 5 and scale-leaves; cones maturing the second year, their bracts minute.....1. PINUS.

Leaves of 1 kind, linear; cones maturing in the first year, their bracts obvious.

Bracts shorter than the scales; branchlets roughened by the persistent leaf bases.

Leaves petioled, jointed on the woody base which is somewhat decurrent on the branchlet; trunk bark fissured or smoothish, not scaly....2. TSUGA.

Leaves sessile, jointed on the woody peg-like base which spreads at right angles to the branchlet; trunk bark marked by scars of deciduous scales..3. PICEA.

Bracts longer than the scales, notched at apex with a spear-like point in the notch; leaf-scars smooth; old bark very rough.....4. PSEUDOTSUGA.

Cones erect on branch, maturing the first year, their scales falling separately; leaf-scars smooth.5. ABIES.

1. PINUS L. PINE.

Trees with two sorts of leaves, the primary leaves thin and scaly or chaff-like, bearing in their axils needle-shaped leaves in fascicles of 1 to 5, which emerge

from slender buds whose scarious scales sheathe the base of the cluster. Staminate catkins spreading, crowded in a whorl at the base of the shoot of the same spring. Ovulate catkins erect, lateral or sub-terminal, 1 to 8 in a whorl. Cones maturing in the second year, reflexed or pendulous, their scales woody, imbricated, the exposed portion (apophysis) often much thickened and bearing centrally an elevated scar or prickly boss (umbo). Cotyledons 4 to 17.—The genus *Pinus*, consisting of about seventy-five species distributed over the northern hemisphere and replaced in the southern hemisphere by the *Araucarias* and *Podocarps*, is strongly represented in California, no other region relatively to area being so rich in species. (*Pinus*, the ancient Latin name.)

WHITE PINES.—Cones subterminal, the apophysis of the cone-scale usually thin and unarmed; needles in 5s; wood light-colored, soft; chiefly high montane.

Cones long-stalked, very long and slender when closed.

Needles 1 to $3\frac{3}{4}$ inches long; cones 6 to 8 inches long; high ranges..1. *P. monticola*.

Needles 2 to $3\frac{1}{2}$ inches long; cones 13 to 18 inches long; high ranges..2. *P. lambertiana*.

Cones with short stalks or almost none; needles 1 to $2\frac{1}{2}$ inches long.

Scales very thick at tip, not closely overlapping; cones subglobose, 1 to 3 inches long; high montane3. *P. albicaulis*.

Scale-tips slightly thickened, rather closely overlapping; cones commonly long-ovate, 2 to 5 inches long; desert mountains chiefly.....4. *P. flexilis*.

YELLOW PINES.—Cones subterminal, sessile or nearly so, the scales with a thick apophysis which is umbonate and armed with a prickly; needles in 5s, 3s, or 2s; wood very pithy.

Needles in 5s.

Cones oblong-ovate, $2\frac{1}{2}$ to 5 inches long; scales with minute prickles; needles $\frac{3}{4}$ to 1 inch long; Mt. Whitney region and high North Coast Ranges..5. *P. balfouriana*.

Cones slender ovate, 3 to $3\frac{1}{2}$ inches long; scales with long slender prickles; needles 1 to $1\frac{1}{2}$ inches long; desert ranges.....6. *P. aristata*.

Needles in 3s, 5 to 10 inches long; cones breaking through near base when falling, some scales remaining on branch.

Cones ovate, 3 to 5 inches long; common at middle altitudes.....7. *P. ponderosa*.

Cones round-oval, 5 to 10 inches long; at higher altitudes.....Var. *jeffreyi*.

Needles in 2s, $1\frac{1}{4}$ to $2\frac{3}{4}$ inches long.

Bark thin, smooth; high montane.....8. *P. murrayana*.

Bark thick, rough; seashore.....9. *P. contorta*.

NUT PINES.—Cones lateral or subterminal, the scales strongly thickened at tip or prolonged into conspicuous spurs or hooks; seeds large, thick shelled, the wing short or none; needles 1 to 5 in a cluster; arid areas and chiefly low altitudes.

Cones very large, with highly developed spurs, breaking through near base when falling, a few lower scales persisting on the branch; needles in 3s.

Cones ovate, 10 to 13 inches long; needles erect, 5 to 14 inches long; trunk persisting through crown as one main axis; foliage yellowish; South Coast Ranges and Southern California.....10. *P. coulteri*.

Cones round-oval, 6 to 10 inches long; needles drooping, 7 to $13\frac{1}{2}$ inches long; trunk branching into several secondary axes; foliage gray; dry interior foothills.....11. *P. sabiniana*.

Cones with pyramidal apophyses.

Needles in 5s, 8 to 12 inches long; cones triangular-oval, 4 to $5\frac{1}{2}$ inches long; scales with pyramidal apophyses; local on south coast.....12. *P. torreyana*.

Needles commonly in 4s, 1 to $1\frac{1}{2}$ inches long; cones subglobose, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; Southern and Lower California.....13. *P. parryana*.

Needles 1 in a place, $1\frac{1}{2}$ to 2 inches long; cones subglobose, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long; desert region14. *P. monophylla*.

CLOSED-CONE PINES.—Cones lateral, sessile, one-sided, opening tardily, often remaining closed for many years, their scales conspicuously swollen at tip; needles in 3s or 2s; lower altitudes, chiefly of coast.

Needles in 2s, 4 to 6 inches long; cones ovate, 2 to 3 inches long, often developing stout spurs; seashore15. *P. muricata*.

Needles in 3s.

- Cones broadly ovoid, $2\frac{1}{2}$ to $4\frac{1}{2}$ inches long; needles 3 to 6 inches long; seashore.
16. *P. radiata*.
 Cones oblong-ovate, 3 to 6 inches long; needles 3 to 5 inches long; montane.....
17. *P. tuberculata*.

1. **P. monticola** Don. SILVER PINE. Forest tree, 50 to 175 feet high, the branches slender and spreading or somewhat drooping and mostly confined to the upper portion of the shaft; trunk 1 to 6 feet in diameter, clothed with a very smooth though slightly checked whitish or reddish bark $\frac{1}{2}$ to $1\frac{1}{4}$ inches thick; needles in 5s, very slender, 1 to $3\frac{3}{4}$ inches long, sheathed at base by thinnish narrow deciduous scales, some of which are 1 inch long; staminate catkins 3 or 4 lines long, 6 or 7 (or more) in a cluster; ovulate catkins borne near the ends of high branches on long peduncles; cones pendulous, 6 to 8, or rarely 10 inches long, very slender when closed and usually curved towards the tip, black-purple or green when young, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches broad near the base when open and tapering to the apex; scales thin, smooth, widening from the base to the rounded apex, chocolate-brown except the apophysis, which is buff and bears a terminal scar-like umbo; seeds 3 to 4 lines long, their wings about 3 times as long, widest at the middle; cotyledons 5 to 9, mostly 7 or 8.

Sierra Nevada, in the main timber belt from 6,000 to 9,000 feet, ranging west to Mt. Shasta, Scott Mts., the Trinities and Siskiyou, and northward to Vancouver Island and northwestern Montana. Its wood is valuable but the species is too weakly represented to be of very great forestal importance.

Refs.—PINUS MONTICOLA Don in Lambert, Pinus, vol. 3, p. 27 (1837), type loc. mountains near Grand Rapids of the Columbia, Douglas; Sargent, Gard. & For. vol. 5, p. 1, fig. 1 (1892); Merriam, Biol. Sur. Mt. Shasta, pp. 39, 136 (1899).

2. **P. lambertiana** Dougl. SUGAR PINE. (Fig. 3.) Forest tree 80 to 250 feet high, the young and adult trees symmetrical, but the aged trees commonly with broken summits or characteristically flat-topped with 1 or 2 long arm-like branches exceeding shorter ones; trunk 2 to 8 feet in diameter, its bark brown or reddish, closely fissured into rough ridges scaly on the surface, 1 to 4 inches thick; needles in 5s, slender, 2 to $3\frac{1}{2}$ inches long; staminate catkins yellowish brown, 3 to 4 lines long, 15 to 25 in a cluster, their pollen-sacs with broad or roundish minutely erose crests; cones pendulous on peduncles (2 to $3\frac{1}{2}$ inches long) at the ends of branches, mostly in the very summit of the tree, very long oblong, 13 to 18 inches long, 4 to 6 inches in diameter when opened; scales broad, only very slightly thickened, rounded at apex and tipped with a terminal scar-like umbo; seeds 4 to 7 lines long with wings twice as long and broadest near the middle; cotyledons 13 to 15.

Sierra Nevada, mainly between 4,000 and 6,500 feet, the fourth most abundant species in the main timber belt. North Coast Ranges: isolated patches on Galloway and Austin creeks in Sonoma Co.; Oathill Mine, Mt. St. Helena, Cobb Mt., Sanhedrin, Bartlett Mt. and north along the Yollo Bollys to South Fork Mt., Trinity Summit, Marble Mt. and Mt. Shasta, thence north into Oregon as far as North Fork Santiam River. South Coast Ranges: reported west of Palo Alto; Santa Lucia and Twin Peaks in Santa Lucia Mts.; San Rafael Mts., eastward to Tehachapi and southward through all the high Southern California ranges (5,000 to 10,000 feet on the Sierra Madre, San Bernardino, San Jacinto and Cucamaca mts.); Lower California. Associated with Yellow Pine, Incense

Cedar and White Fir. The largest of all pines. Wood light, soft, straight-grained, of high commercial value.

Refs.—*P. LAMBERTIANA* Douglas. Trans. Linn. Soc. vol. 15, p. 500 (1827), type loc. Umpqua River Mts., Oregon. Douglas. Comp. Bot. Mag., vol. 2, pp. 92, 106, 107, 130, 152 (1836); Sudworth, 21st Rep. U. S. Geol. Sur. pt. 5 (For. Res.), p. 522 (1903); Jepson, Fl. W. Mid. Cal. p. 20 (1901). Sugar Pine, Cooper. For. Service Bull. no. 69 (1906).

3. *P. albicaulis* Engelm. WHITE-BARK PINE. (Fig. 1.) Subalpine tree, usually dwarfish or prostrate; trunk $1\frac{1}{2}$ to 2 feet in diameter, often with 2 or 3 main stems from the base, 2 to 40 feet high; bark thin, whitish and smooth, or fissured into scaly plates on the main trunk; needles in 5s. 1 to $2\frac{1}{2}$ inches long, persisting 5 to 7 years, densely clothing the tips of the slowly growing branchlets; catkins scarlet; cones ovoid or subglobose, yellowish brown, 1 to 3 inches long and nearly as thick; scales broad and rounded at apex with a short acute umbo, not overlapping closely but their tips strongly thickened and either projecting freely or presenting very bluntish points; seeds obovate, acute, not compressed

or only on one side, obscurely margined towards the point, $\frac{1}{3}$ to $\frac{1}{2}$ inch long; wing narrow, usually persistent on the scale; cotyledons 7 to 9.

Subalpine on the Sierra Nevada, southward to the San Bernardino Mts., north to British Columbia and easterly to the Rocky Mts. In the Coast Ranges it occurs on a few high peaks (Salmon Mts., Marble Mt.). In the Sierra Nevada it is a timber line tree, between 8,000 and 10,000 feet in the south and 6,000 to 8,000 feet in the north, forming a very thin and scattered scrubby growth on exposed slopes. Where winter snows accumulate to great depth on plateaus or in cirques it occurs as low trees only 2 or 3 feet high but with a flat or table-like top 6 to 10 feet broad.



FIG. 1. *P. ALBICAULIS* Engelm. a. Closed cone; b, seed, nat. size.

Refs.—*P. ALBICAULIS* Engelm. Trans. St. Louis Acad. vol. 2, p. 209 (1863), type loc. Oregon Cascades. Newberry; Merriam. Biol. Sur. Mt. Shasta, pp. 39, 137 (1899). *P. flexilis* var. *albicaulis* Engelm. in Bot. Cal. vol. 2, p. 124 (1880).

4. *P. flexilis* James. LIMBER PINE. Tree 10 to 60 feet high with a short trunk 1 to 3 feet in diameter; needles in 5s. 1 to $2\frac{1}{4}$ inches long, often curving, densely clothing the ends of the branchlets and forming a sort of brush; catkins reddish; cones buff or olive-buff, globose to long-ovate, 2 to 5 inches long; scales broad with rounded slightly thickened tips and terminal scar-like umbo, overlapping rather closely and leaving only a narrow portion free on the upper side the scale; seeds nearly oval, markedly compressed, surrounded by an acute margin, 4 or 5 lines long; wing narrow, generally persistent on scale; cotyledons 6 to 9.

Subalpine, 7,000 to 12,000 feet: east slope of Sierra Nevada from Mono Pass south to Monache Peak, attributed to west slope on high ridges south side of South Fork Kings River: Panamint Range; Mt. Pinos (Ventura Co.); Sierra Madre and San Bernardino mts.; San Jacinto Mts. (W.L.J. no. 2308); El Toro Peak. Ranges far east to Rocky Mts. of New Mexico and north to Alberta.

Refs.—*PINUS FLEXILIS* James, Long's Exped. vol. 2, p. 35 (1823); Coville, Bot. Death Val. p. 221 (1893).

5. **P. balfouriana** Jeffrey. FOXTAIL PINE. Subalpine tree, 20 to 45 feet high, with cone-shaped trunk 1 to 4 feet in diameter at the base, the axis in old or in storm-beaten trees at timber line projecting through the crown as a dead and shining splinter point; trunk bark reddish brown, smoothish but superficially checked; branches stout and rather short with half-drooping branchlets thickly clothed with short needles persisting 10 to 15 years and thus resembling a fox's tail; needles in 5s, bright green on the upper side, glaucous on the lower, $\frac{3}{4}$ to 1 inch long; cones slender when closed, oblong-ovate in outline when open, terra-cotta color, $2\frac{1}{2}$ to 5 inches long, $1\frac{3}{4}$ to 2 inches broad; tips of the scales thickened or low-pyramidal, with shrunken scar-like umbo; seeds $3\frac{1}{2}$ to 4 lines long, their wings narrow, 6 to 11 lines long; cotyledons 5.

Timber line tree local in two widely separated areas: North Coast Ranges from South Yollo Bolly north to the Scott Mts. and Marble Mt.; southern Sierra Nevada from Olanche Peak northward over the Whitney Plateau to Bubbs Creek and South Fork San Joaquin, and westward to the Chagoopah Plateau and Alta Peaks.

Refs.—*PINUS BALFOURIANA* Jeffrey, Oreg. Exped. 1, t. 3, fig. 1 (1853), type loc. Scott Mts., *John Jeffrey*; Lemmon, 2d Rep. Cal. Board For. pp. 71, 86, t. 5 (1888); Jepson, Sierra Club Bull. vol. 4, p. 214, pl. 75 (1903).

6. **P. aristata** Engelm. HICKORY PINE. Bushy tree 15 to 40 feet high; leaves 1 to $1\frac{1}{2}$ inches long; young bark milky white; cones slender ovate, 3 to $3\frac{1}{2}$ inches long, the scales armed with slender prickles 3 lines long.

High mountains of Nevada, northern Arizona and New Mexico, east to central Colorado and westward to the Death Valley region of California where it is found on the Funeral, Grapevine, Charleston and Panamint ranges between 7,500 and 11,000 feet. Wood of poor quality but on account of timber scarcity it is lumbered in central Nevada where it is known as "White Pine."

Refs.—*PINUS ARISTATA* Engelm., Am. Jour. Sci. ser. 2, vol. 34, p. 331 (1862); Sargent, Silva, vol. 11, p. 63, t. 554 (1897). *P. balfouriana*, var. *aristata* Engelm., in Bot. Cal. vol. 2, p. 125 (1880).

7. **P. ponderosa** Dougl. YELLOW PINE. (Fig. 2.) Forest tree 60 to 225 feet high, the trunk 2 to 9 feet in diameter and often clear of branches for 40 to 100 feet; branches horizontal or drooping; trunk bark in typical trees tawny yellow, divided by fissures into large scaly-surfaced plates 1 to 4 feet long and $\frac{1}{2}$ to $1\frac{1}{4}$ feet wide; needles in 3s, 5 to 10 inches long; staminate catkins yellow, in rosette-like clusters, slender in anthesis and 1 to 2 inches long; ovulate catkins purplish, oblong-ovate, 6 to 8 lines long; cones reddish brown, narrowly ovate when closed, roundish ovate or oval when open, commonly 3 to 5 inches long; after opening breaking through near the base and falling, leaving the basal scales on the limb; scales with thickened or low-pyramidal apophyses, the umbo abruptly drawn down into a stout somewhat triangular point or short prickle; seeds ovate, sometimes slightly flattened at apex, 3 to 5 lines long, the wing broadest near the middle and tapering to apex, $\frac{7}{8}$ to 1 inch long and $4\frac{1}{2}$ lines broad; cotyledons 5 to 9.

Sierra Nevada and Coast Ranges at middle altitudes, north to British Columbia, east to the Rocky Mts., south to the summit of the high mountains of Southern



FIG. 2. *PINUS PONDEROSA* Dougl. Open cone, broken through near base in falling, lower scales persisting on branch. nat. size.

California and into Lower California. It is the most abundant tree in the main timber belt of the Sierra Nevada (5,000 to 7,500 feet at the south, and 3,000 to 5,500 feet at the north). In the South Coast Ranges it is comparatively scarce and its distribution more localized; it occurs in the southern Santa Lucias and north to Pico Blanco, on the Pinnacles, Santa Cruz Mts. above Laurel Station, and in the Mt. Hamilton Range in one limited locality. In the North Coast Ranges it occurs in the Napa and Mt. Hood ranges, is abundant in the inner ranges north of Clear Lake, but nowhere penetrates the Redwood Belt or reaches the neighborhood of the ocean as it does in the South Coast Ranges. It grows on rich mountain slopes, rocky cliffs, dry mesas, gravelly valley floors and is more abundant and widely distributed throughout the State than any other tree.

The wood is hard, strong, but not tough, of high commercial value, commonly marketed as "white pine" but sometimes so light and fine-grained as to be graded with Sugar Pine stock and sold as such. Rougher-barked trees with inferior wood are called Bull Pine and Jack Pine by woodsmen.

Var. *jeffreyi* Vasey. **JEFFREY PINE.** Forest tree 60 to 125 or 170 feet high with yellowish or wine-colored trunks, the bark broken into roughish plates; cones larger and denser, 5 to 10 inches long, shaped when open like an old-fashioned straw hive; prickle of the umbo often more slender; seeds often obovate, 5 to 7 lines long with a wing 12 or 13 lines long; cotyledons 7 to 13.—Sierra Nevada, the typical form in a marked belt at higher elevations (5,000 to 8,000 feet) than the species but everywhere passing over into it at lower elevations. It ranges north into southern Oregon and southward to Southern California (where it is common on the higher mountain summits) and into Lower California.

Refs.—*PINUS PONDEROSA* Douglas in Lawson, *Man.* p. 355 (1836), *Comp. Bot. Mag.* vol. 2, p. 111 (1836), type loc. near Spokane River, *Douglas*; Newberry, *Pac. R. Rep.* vol. 6, pt. 3, p. 36, pls. (1857); Jepson, *Fl. W. Mid. Cal.* p. 21 (1901). *P. benthamiana* Hartweg, *Jour.*

Hort. Soc. Lond. vol. 2, p. 189 (1847); Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 212, t. (1849).
 Var. *jeffreyi* Vasey, Rep. U. S. Com. Agr. p. 179 (1875). *P. jeffreyi* Balfour, Rep. Oreg. Exped. no. 2, t. 1 (1853), type loc. Shasta Valley, *John Jeffrey*.

8. **P. murrayana** Balf. TAMRAC PINE. Forest tree of symmetrical habit, commonly 50 to 80 feet, but sometimes 125 feet high, or when stunted but a few feet high; bark remarkably thin, rarely more than $\frac{1}{4}$ inch thick, light gray in color, very smooth but flaking into small thin scales; needles in 2s, $1\frac{1}{2}$ to $2\frac{3}{4}$ inches long; staminate catkins 4 or 5 lines long, yellow, 15 to 60 in spike-like clusters; ovulate catkins 2 or 3 lines long, chiefly 2 in a whorl; cones chestnut brown, oblong, but more or less globose when open, 1 to $1\frac{1}{2}$ inches long; scales thickened at the ends, black-banded at their tips inside, with a central umbo prolonged into a slender sub-persistent prickle; seeds 2 lines long, the wing broadly oblong, 5 or 6 lines long; cotyledons 4 or 5.

Sierra Nevada, 6,000 to 10,000 feet, southward to the San Bernardino and San Jacinto mts., north to Mt. Shasta and thence west to Marble Mt. (W.L.J. no. 2813) and the Klamath Range. Beyond our borders it ranges north to Alaska, Montana and east to Colorado. In the Sierra Nevada it forms dense forests, especially about swampy meadows, or at higher altitudes becomes a dwarfed timber-line tree. First collected by John Jeffrey, whose label on original specimen in the Herbarium of the Edinburgh Botanic Garden reads thus: "Found on the Siskiyou mountains in Lat. 43° . Elevation 7,500 feet, growing on moist deep loamy soil. Oct. 21 [1852]. This all the cones I could procure. Tree 40 feet high, of a conical form."

Refs.—*PINUS MURRAYANA* Balfour, Rep. Oreg. Exped. p. 2, t. 3 (1853); Merriam, Biol. Sur. Mt. Shasta, p. 38 (1899); Jepson, Sierra Club Bull. vol. 4, p. 208, pl. 74 (1903). *P. contorta* var. *murrayana* Engelmann in Bot. Cal. vol. 2, p. 126 (1880).

9. **P. contorta** Dougl. BEACH PINE. Scrub pine 2 to 35 feet high, commonly with depressed or irregular dark green crown, the trunk mostly $\frac{1}{4}$ to $1\frac{1}{4}$ feet in diameter and clothed in dark rough bark; needles in 2s, $1\frac{1}{4}$ to 2 inches long, clothing the branchlets densely; staminate catkins yellow, 20 to 65 in a spike-like cluster, conical, 3 to 4 lines long; ovulate catkins red, borne 1, 2 or 3 in a whorl, 2 lines long; cones narrowly ovate or sub-cylindric, somewhat oblique, globose when open, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, falling after 4 or 5 years or remaining on the tree many years; apophysis low pyramidal, bearing a very slender prickle which weathers away in age; seeds $1\frac{1}{2}$ to 2 lines long, the wing 3 to 6 lines long; cotyledons 4 or 5.

Coast of California from the Albion River (Mendocino Co.) northward to the sand dunes of the Oregon and Washington shores and the sphagnum bogs of Alaska.

Var. **bolanderi** Vasey. Cane-like dwarfs 2 to 5 feet high with very small cones.—Mendocino "White Plains," (W.L.J. no. 2166).

Refs.—*PINUS CONTORTA* Douglas in Loudon, Arb. Britt. vol. 4, p. 2292, figs. 2210, 2211 (1838), type loc. mouth of the Columbia River, *Douglas*; Lemmon, *Erythea*, vol. 2, p. 174 (1894). Var. *bolanderi* Vasey, Rep. U. S. Dept. Agr. 1875, p. 177 (1876). *P. bolanderi* Parlatores, DeCandolle, Prodr. vol. 16, pt. 2, p. 379 (1869).

10. **P. coulteri** Don. BIG-CONE PINE. Tree commonly 40 to 90 feet high, with conical or more often spreading crown, long lower branches, yellowish green foliage and trunks 1 to $2\frac{1}{2}$ feet in diameter; trunk bark dark, roughly broken so as to form an irregular network of longitudinal fissures and sometimes loosening superficially into large thinnish scales; needles in 3s, erect, tipped with a short hard point, 5 to 10 (or 14) inches long; staminate catkins 15 to 65 in

a cluster, at length cylindric and 1 inch long; ovulate catkins in whorls of 3 to 5; cones ovate, or when open, broadly ovoid, 10 to 13 inches long and 5 to 7½ inches thick, when falling breaking through near the base; scales at tip rather abruptly passing into prominent tusk-like points or spurs which towards the base of the cone on the outer side are developed into eurved talon-like appendages; seeds pinkish or yellowish, 6 to 8 lines long, the wing ¾ to 1¼ inches long; cotyledons 10 to 14.

Dry slopes and ridges: San Jacinto and San Bernardino mts. of Southern California (from 3,000 to 6,000 feet, where it attains its best development), southward into northern Lower California, northward to the Santa Lucia, San Carlos, Gabilan and Mt. Hamilton ranges. In the latter range it favors almost exclusively the eastern slope (3,000 to 4,000 feet) and grows most luxuriously on Mt. Day (W. H. Wright). The most northerly locality is Mitchell Rock, Mt. Diablo, near the village of Clayton, 800 feet altitude. The Mt. Diablo trees were described as *Var. diabloensis* by Lemmon (Sierra Club Bull. vol. 4, p. 130,—1902).

Refs.—*PINUS COULTERI* Don, Trans. Linn. Soc. vol. 17, p. 440 (1837), type loc. Santa Lucia Mts. near Twin Peaks, *Coulter*; Leiberg, 20th Rep. U. S. Geol. Sur. pt. 5 (For. Res.), pp. 422, 443 (1900). *P. sabiniana* Parry, Bot. Mex. Bound. p. 210, t. 57 (1859) not of Dougl.

11. ***P. sabiniana*** Dougl. **DIGGER PINE.** Singular pine 40 to 70 or occasionally 90 feet high, with open crown and thin gray foliage; trunk 1 to 4 feet in diameter, frequently slanting, in typical trees branching at 5 to 15 feet from the ground into a cluster of slender erect branches which form a broom-like top; needles in 3s. in drooping clusters, 7 to 13½ inches long; staminate catkins at length cylindric, 8 to 11 lines long, 8 to 21 in a spike-like cluster; ovulate catkins 6 lines long, 1, 2 or 3 in a whorl (or occasionally 2 distinct whorls on a season's shoot), borne on erect stalks 2 to 2½ inches long; one-year-old cones ovoid-globose, about 2 inches long, on recurved stalks, with the basal scales more or less free and recurved-spreading or deflexed; mature cones ovate, subglobose when open, 6 to 10 inches long, 5 to 7 inches broad, only slightly unsymmetrical, persistent on the tree 1 to 7 years, when falling breaking through near the base leaving the basal portion on the limb ("broken-cone" type); tips of the scales gradually passing into strong triangular spurs; spurs straight or curved, or even hooked, especially on lower part of cone, about 1 inch long; seeds oblong in outline, slightly flattened, slightly ridged towards the micropyle, ¾ to 1 inch long, 4 or 5 lines wide, bearing an oblique wing 3 to 5 lines long and ½ inch broad; shell hard, covered with a thin black coat which is eventually more or less deciduous; cotyledons 11 to 17.

Mountain slopes, hills and gravelly valleys; Sierra Nevada foothills, always as scattered trees or in very open stands, associated with the Blue Oak and Interior Live Oak between 500 and 1,400 feet, growing alone on the slopes or over chaparral areas between 1,400 and 3,000 feet; Coast Ranges (especially inner ranges such as Vaca, Napa, Diablo, Hamilton and San Carlos) from South Fork Salmon River (northernmost locality) and the Sacramento River Cañon south to Sierra Liebre (southernmost locality). Does not occur on the seaward North Coast Range (Redwood Belt) or only sparingly on eastern slope from Dry Creek to Cloverdale. Found on the east slope of the Santa Lucia Mts., local on west slope; also on east slope of the Santa Cruz Mts. about Saratoga. Occasionally as high as 5,000 feet (Santa Ynez Range, Kern River Valley) and as low as 175 feet (Napa Valley). Also called Gray Pine, Blue Pine and



FIG. 3. *PINUS LAMBERTIANA* Dougl. Characteristic crowns, the branches of very unequal length.
(Mt. San Jacinto.)



FIG. 4. PINUS MURICATA Don. Trees with flattened crowns which long ago reached normal height. The roughening of the branches is caused by the circles of cones which persist 15 to 25 years. (Road to Pt. Reyes Light in a wind-gap of the hills.)

Sabine Pine. "A well-defined species, in the happy position of having no synonyms."—Masters, 1904.

Refs.—*PINUS SABINIANA* Douglas, Trans. Linn. Soc. vol. 16, p. 747 (1833), type loc. probably near San Juan Bautista, *Douglas*; Davidson, *Erythra*, vol. 3, p. 156 (1895); Jepson, *Fl. W. Mid. Cal.* p. 22 (1901).

12. *P. torreyana* Parry. TORREY PINE. Low crooked or sprawling tree 15 to 35 feet high, or sometimes straight and 60 feet high; needles in 5s, 8 to 12 inches long; cones triangular ovate, 4 to 5½ inches long, the scales at apex thickened into heavy pyramids; cotyledons 12 to 14.

Local on the San Diego coast about Del Mar (type loc.) and on Santa Rosa Island.

Refs.—*PINUS TORREYANA* Parry, Bot. Mex. Bound. Sur. p. 210, t. 58, 59 (1859); Engelmann in Bot. Cal. vol. 2, p. 125 (1880).

13. *P. parryana* Engelm. PARRY PIÑON. Short-trunked low tree 15 to 30 feet high; needles 1¼ to 1½ inches long, usually 4 (sometimes 2, 3 or 5) in a cluster; cones subglobose, ¾ to 1½ inches long; seeds with rudimentary wings.

San Jacinto Range and southward into Lower California.

Refs.—*PINUS PARRYANA* Engelmann, Am. Jour. Sci. ser. 2, vol. 34, p. 332 (1862), in Bot. Cal. vol. 2, p. 124 (1880). *P. quadrifolia* Sudworth, U. S. Div. For. Bull. no. 14, p. 17 (1897); Sargent, *Silva*, vol. 11, p. 43, t. 549 (1897).

14. *P. monophylla* Torr. ONE-LEAF PIÑON. Low flat-crowned tree 8 to 25 (or 45) feet high, the trunk very short; needles 1 in a place, cylindric, curving upward and ending in an abrupt point, 1½ to 2 inches long; staminate catkins dark red; cones subglobose, chocolate-brown or yellow, 2½ to 3½ inches in diameter; scales thick, raised at apex into high broad-based pyramids with slightly umbilicate or flattened summits bearing a minute deciduous prickle; seeds dark brown, oblong in outline, slightly flattened, ¾ inch long, without wings; cotyledons 7 to 10.

Desert regions of California eastward to Utah and Arizona and southward to Lower California. Scattered along eastern slope of Sierra Nevada from Sierra Co. southward; on western slope occurring in a few isolated localities on the three forks of the Kings River (5,500 to 6,500 feet) and on the walls of the Grand Cañon of the Kern (8,000 to 9,000 feet); southward to the Tehachapi Range, San Bernardino Mts. and Lower California, and westward to the San Rafael Mts. Growth always scattered. Seeds a precious article of food to the native tribes of the desert.

Refs.—*PINUS MONOPHYLLA* Torrey in Fremont, Rep. Second Exped. p. 319, pl. 4 (1845); Fremont, Rep. Second Exped., pp. 221, 222, 225, 226, 229 (1845), type loc. Walker River, Inyo Co., *Capt. Fremont*; Masters, *Ann. Bot.* vol. 2, p. 124 (1888); Leiberg, 20th Rep. U. S. Geol. Sur. pt. 5 (For. Res.), pp. 423, 444 (1900).

15. *P. muricata* Don. BISHOP PINE. (Figs. 4 and 5.) Littoral tree 40 to 80 feet high with trunk 1 to 3 feet in diameter, the axis and branches with persistent circles of cones from near the base to the summit; bark 1 to 1½ inches thick, dark red, brown on the surface, soft and brittle, broken by fissures into rough ridges; needles in 2s, 4 to 6 inches long; staminate catkins ovate, 3 or 4 lines long, 12 to 60 in a cluster, their peduncles exerted from the winter bud; ovulate catkins 2 to 5 in a whorl, 1 to 5 whorls on a season's shoot; cones broadly ovate, acute, 2 to 3 inches long, almost as broad, or when open more or less globose, borne 3, 4 or 5 in a circle, gradually turned downward, developed more strongly on the outside towards the base and in consequence always one-sided;

scale-tips rhomboidal, bearing a central prickle with a broad base, or developed into stout straightish or upwardly curving spurs; seeds black, sometimes mottled, the thin shell minutely roughened on the surface, $2\frac{1}{2}$ to 3 lines long, wings narrow, 5 to 8 lines long, $2\frac{1}{2}$ to $3\frac{1}{2}$ lines broad; cotyledons 4 to 7.

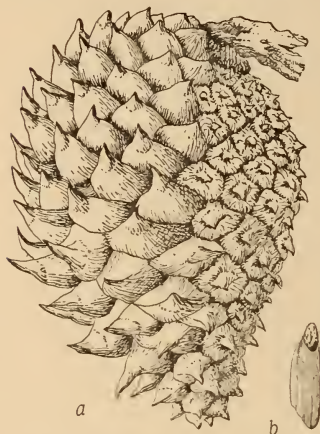


FIG. 5. *PINUS MURICATA* Don. a, Closed cone; b, seed. nat. size.

Low swampy lands or clay hills bordering the sea: North Coast Ranges from Inglenook, Mendocino Co. (W.L.J. no. 2161) southward nearly to Bolinas, attaining its best development on the Sonoma coast; South Coast Ranges at Monterey (Dr. Abbott; W.L.J. no. 2986) and San Luis Obispo Co.; Lower California between Ensenada and San Quentin and on Cedros Island. Fire type of pine, its cones remaining closed 10 to 20 years, or opening after a forest fire and reseeding the area. Stands dense but of very limited extent. First discovered by Dr. Thos. Coulter in the Santa Lucia Mts. near San Luis Obispo, 3,000 feet altitude and 10 miles from the sea.

Refs.—*PINUS MURICATA* Don, Trans. Linn. Soc. vol. 17, p. 441 (1837); Torrey, Bot. Mex. Bound. p. 209, pl. 54 (1859); Purdy, Gard. & For. vol. 9, p. 242 (1896); Jepson, Fl. W. Mid. Cal. p. 23 (1901).

16. *P. radiata* Don. MONTEREY PINE. (Fig. 6.) Beautiful, symmetrical tree or in age with flattened or broken top, 30 to 70 or 115 feet high; foliage rich dark green; trunk 1 to 4 feet in diameter; bark hard and more nearly black than that of any other Californian pine; needles in 3s, or a few in 2s, 3 to 6 inches long; staminate catkins yellow, 20 to 40 in a cluster, conic-cylindric, 6 or 7 lines long, the peduncles not exerted from the winter bud; ovulate catkins peduncled, borne 2 to 5 in a whorl, 1 to 3 whorls formed on a shoot in a season; cones tan-color or cinnamon, deflexed, sessile and unequally developed, broadly ovoid and bluntly pointed, globose when open, $2\frac{1}{2}$ to $4\frac{1}{2}$ inches long; scales on the outer side toward the base conspicuously swollen at tip into a hemispherical tubercle or boss and armed with a prickle which usually weathers off; seeds black, minutely roughened on the surface, 3 lines long, bearing a broadly oblong brown wing $2\frac{1}{2}$ to 3 times as long; cotyledons 5 to 8.

Near sea on south coast: about Pesadero, San Mateo Co.; Monterey (type loc., Thos. Coulter); San Simeon Bay; Santa Rosa, Santa Cruz and Guadalupe islands. Although naturally confined to a few localities of limited area, it takes kindly to cultivation in all temperate regions of the earth and has a wider horticultural distribution than any other Californian tree. It is commonly planted along the Pacific Coast for ornament and as a shelter tree but is short-lived in the dry interior valleys.

Refs.—*PINUS RADIATA* Don, Trans. Linn. Soc. vol. 17, p. 442 (1837); Lemmon, Erythraea, vol. 1, p. 224 (1893); Jepson, Fl. W. Mid. Cal. p. 22 (1901). *P. insignis* Douglas in Loudon,

Arb. Britt. vol. 4, p. 2265, figs. (1838); Engelmann in Bot. Cal. vol. 2, p. 127. *P. tuberculata* Don, Trans. Linn. Soc. vol. 17, p. 442 (1837).

17. *P. tuberculata* Gord. KNOB-CONE PINE. Tree 5 to 30 or sometimes 85 feet high, with slender trunks $\frac{1}{3}$ to 1 foot in diameter and rather thin pale yellow-green foliage; needles in 3s. 3 to 5 inches long; staminate catkins brownish purple, narrowly conic, 5 to 7 lines long, 50 to 60 in spike-like clusters;

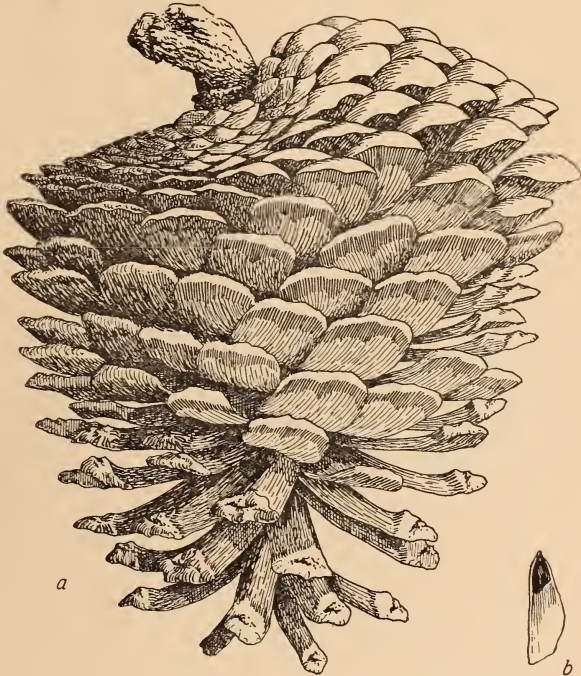


FIG. 6. *PINUS RADIATA* DOR. *a*, Open cone; *b*, seed. nat. size.

ovulate catkins dark-red or straw-brown, on peduncles $\frac{3}{4}$ to 1 inch long, 3 to 5 (or 7) in a whorl, 1 to 3 whorls formed on a season's shoot; cones strongly deflexed, buff in color, narrowly ovate, oblique, acutely or bluntly pointed and somewhat curved, especially at tip, 3 to 6 inches long; scales moderately thickened at tip, except on the outside towards the base where they are raised into conspicuous rounded or pointed knobs; umbos small and contracted into slender prickles which, on old cones, weather away or persist towards the apex; seeds brownish black, 3 to 4 lines long, the surface minutely roughened, the wing 9 to 12 lines long and 3 to 4 lines broad; cotyledons 5 to 8.

Sierra Nevada and Coast Ranges, arid situations with barren or rocky soil, chiefly between 1,500 and 3,000 feet, widely distributed but the localities comparatively few and rarely abundant in a locality except in Siskiyou and Del Norte cos. and southwestern Oregon. Ranges southward to San Bernardino and San Jacinto mts. Fire type of pine, the cones remaining closed 15 to 30 years, or until opened by a forest fire when the species reproduces itself abundantly on the burned area. The following stations may be noted: Devils Backbone, near Trinity Summit; Bartlett Mt.; near Mt. Konokti; Mt. St. Helena; Moraga Ridge; near Post Summit, Santa Lucia Mts.; Kinsley, Mariposa Co.; Forest Hill; Fall River; Mt. Shasta. (Type loc. Santa Cruz Mts., Theo. Hartweg.)

Refs.—*PINUS TUBERCULATA* Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 218, t. (1849), not Don. *P. attenuata* Lemmon, Min. Sci. Press, vol. 64, p. 45 (1892), *Erythra*, vol. 1, p. 231 (1893); Jepson, Fl. W. Mid. Cal. p. 22 (1901); Merriam, Biol. Sur. Mt. Shasta, p. 33 (1899).

2. *TSUGA* Carr. HEMLOCK.

Slender trees with nodding leading shoots. Leaves linear; resin canal 1; petioles jointed on a woody base which persists after leaf-fall as a decurrent projection roughening the branchlet. Staminate catkins pendulous, consisting of a subglobose cluster of stamens on a long peduncle arising from an axillary winter bud. Anthers subglobose, tipped with a short spur or knob, their cells opening transversely. Ovulate catkins erect, from terminal winter buds. Cones maturing in the first autumn, solitary on ends of branchlets, pendent; scales thin, longer than the bracts. Seeds with resin vesicles on the surface; cotyledons 3 to 6.—Seven species, 2 in eastern North America, 2 in western North America, 2 in Japan and 1 in the Himalayas. (*Tsuga*, its Japanese name.)

Leaves in flat sprays; cones $\frac{1}{2}$ to 1 inch long.....1. *T. heterophylla*.
Leaves spreading around stem; cones $1\frac{1}{2}$ to 3 inches long.....2. *T. mertensiana*.

1. *T. heterophylla* Sarg. COAST HEMLOCK. Graceful conifer, 100 to 180 feet high, with trunk 1 to 4 feet in diameter, the branches and branchlets slender, forming sprays which droop cascade-wise but not pendulous; trunk bark brown on the surface, dark red inside, shallowly fissured longitudinally or nearly smooth, $\frac{1}{2}$ to $\frac{3}{4}$ inch thick, or sometimes twice as thick and deeply broken into small oblong plates an inch high, producing an irregularly warty appearance; branchlets finely hairy with the leaves mostly spreading in 2 ranks; leaves linear, flat, 3 to 8 lines long, $\frac{1}{2}$ to 1 line wide, blunt at apex, upper side green and with a median furrow, lower side white and with a median ridge, contracted at base into a short but distinct petiole; staminate catkins subglobose, about 2 lines long, borne on thread-like peduncles 2 or 3 lines long, occurring at the ends of branchlets; cones oblong or conical when closed, roundish when open, $\frac{1}{2}$ to $\frac{3}{4}$ or 1 inch long, pendulous and solitary on the tips of the branchlets; scales longer than broad, roundish at apex, with entire edge; bracts about one-sixth the length of the scales, broadly triangular with truncate or obtuse summits; seeds light-brown, $1\frac{1}{4}$ line long, the wing 3 or 4 lines long and twice the breadth of the seed.

West slope of the outer Coast Range from Elk Creek, Mendocino Co., north to Oregon and Alaska, and eastward to western Montana. Scattered singly through the Redwood forest, abundant beyond our borders. Long attributed to Marin Co. but no definite station ever given and believed not to exist in that county. Also called "Western Hemlock."

Refs.—*TSUGA HETEROPHYLLA* Sargent, *Silva N. Am.* vol. 12, p. 73, t. 605 (1898); Jepson, *Fl. W. Mid. Cal.* p. 19 (1901). *Abies heterophylla* Rafinesque, *Atlant. Jour.* vol. 1, p. 119 (1832). *T. mertensiana* Carrière, *Traité Conif.* ed. 2, p. 250 (1867); Engelmann in *Bot. Cal.* vol. 2, p. 120 (1880). Western Hemlock, Allen, *U. S. Bur. For. Bull.* no. 33 (1902).

2. ***T. mertensiana* Sarg.** ALPINE HEMLOCK. Alpine tree 25 to 90 (rarely 115) feet high, with conical trunk $\frac{1}{2}$ to $2\frac{1}{2}$ feet in diameter, bearing branches quite to the ground and forming pyramidal bases which are soon narrowed to slender tops; branches slender, horizontal or mostly drooping, the branchlets slender, pubescent and drooping; leaves standing out all around the branchlet, flattish above, strongly ridged below, bearing stomata on both surfaces, bluntish at apex, $\frac{1}{4}$ to 1 inch long, less than 1 line wide, shortly petioled; staminate catkins mostly violet-purple, 2 lines long, on peduncles 2 to 3 lines long; cones cylindric and tapering to base and apex, $1\frac{1}{2}$ to 3 inches long, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter; opened cones oblong in outline or tapering from base to apex, 1 to $1\frac{1}{4}$ inches in diameter; scales thin, rounded at apex, in the open cone spreading at right angles to the axis or even recurving, their bracts $\frac{1}{3}$ to $\frac{2}{5}$ as long, rounded above and tipped with a short point; seeds $2\frac{1}{2}$ lines long, the wing 4 or 5 lines long.

Timberline tree in the Sierra Nevada, 6,000 to 11,000 feet, in frequent patches of limited extent, from Bubb's Creek northward to Mt. Shasta, westward to the Trinity Mts., Marble Mt. (W.L.J. no. 2820), Klamath Range and Siskiyou, far north to Alaska and northern Montana. Fruit-bearing branchlets often forming dense drooping clusters of cones in top of tree. Trunks on sharp slopes kneed or curved at base from the weight of snow on the stems when young. Also called Black Hemlock and, in former times, "Williamson Spruce."

Refs.—*TSUGA MERTENSIANA* Sargent, *Silva N. Am.* vol. 12, p. 77, t. 606 (1898). *Pinus mertensiana* Bongard, *Veg. Sitcha*, p. 163 (1833), type loc. Sitka, *Dr. R. H. Mertens*. *Abies williamsonii* Newberry, *Pac. R. Rep.* vol. 6, pt. 3, p. 53, t. 7, f. 19 (1857). *Tsuga pattoniana* Seneclauze, *Conif.* p. 21 (1867); Engelmann in *Bot. Cal.* vol. 2, p. 121 (1880); Sargent, *Gard. & For.* vol. 10, p. 1, figs. 1, 2 (1897).

3. **PICEA** Link. SPRUCE.

Trees with tall tapering trunks and thin scaly bark. Leaves narrowly linear, spreading on all sides, jointed near the stem on a woody base which persists after leaf-fall as a prominent spreading "peg;" resin canals in ours 2. Staminate catkins from terminal or axillary winter buds, erect or nodding; anthers with nearly circular toothed crests, opening longitudinally. Ovule-bearing catkins erect. Cones maturing in the first autumn, pendent, usually scattered over the upper half of the tree; scales very thin, the bracts shorter than the scales. Seeds without resin vesicles; cotyledons 4 to 15.—About 12 species, 7 in North America, the remainder in Europe and Asia. (*Picea*, ancient Latin name, from *pix*, pitch.)

Leaves prickly pointed; cone-scales serrulate; coastal.....1. *P. sitchensis*.
Leaves merely acute; cone-scales entire; subalpine.....2. *P. breweriana*.

1. ***P. sitchensis* Carr.** TIDELAND SPRUCE. Forest tree 80 to 190 feet high, with trunk 3 to 20 feet in diameter, wide spreading rigid branches, and drooping branchlets; trunk bark reddish brown, developing roughish deciduous scales, but these not so sharply defined as in spruces generally; branchlets with the leaves spreading equally in every direction but not straight down on the under side of horizontal ones; leaves linear, $\frac{1}{2}$ to 1 inch long, $\frac{2}{3}$ to 1 line

wide, whitened and flat above but with a median ridge, convex or strongly ridged below, very stiff and usually tapering to a prickly point or the upper leaves less sharp or bluntly pointed; staminate catkins purple, 1 to $2\frac{1}{2}$ inches long and 3 to 6 lines in diameter, borne on a peduncle 2 or 3 lines long, appearing from large conspicuously sealy winter buds which are either terminal or lateral on the branches; ovulate catkins erect or curving upwards, $1\frac{1}{4}$ to $1\frac{3}{4}$ inches long, yellowish green, the bracts longer than the scale; cones dull brown, long oblong, 2 to 4 inches long and when open $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter; scales narrow, finely and irregularly toothed, with ovate-lanceolate bracts $\frac{1}{2}$ to $\frac{2}{3}$ as long; seeds $1\frac{1}{3}$ lines long, the wing 3 to 4 lines long and $1\frac{1}{2}$ to 2 lines broad.

Lowlands facing the ocean from Caspar, Mendocino Co., northward to Alaska. Forms pure forests on low moist flats as at Crescent City, or about the mouth of the Eel River where the tall wind-beaten trees are a striking feature of the scenery. The tallest trees of this species in California occur in the western margin of the Redwood Belt in Del Norte Co. (W.L.J. no. 2905), where the trunks, as also northward, are enormously buttressed at base; trunks 2 to 6 feet in diameter at 6 feet above the ground are nearly twice that diameter at the ground. Extensively lumbered. In cultivation called Sitka Spruce and, formerly, Menzies Spruce.

Refs.—*PICEA SITCHENSIS* Carriere, *Traite Conif.* p. 260 (1855). *Pinus sitchensis* Bongard, *Veg. Sitka*, p. 164 (1833), type loc. Sitka, *Dr. Mertens. Abies menziesii* Lindley, *Penny Cycl.* vol. 1, p. 32 (1833); Newberry, *Pac. R. Rep.* vol. 6, pt. 3, pp. 56, 90, f. 21, pl. 9 (1857).

P. ENGELMANNI Engelm. Engelmann Spruce. Branchlets pubescent; cones $2\frac{1}{2}$ to 3 inches long, $1\frac{1}{2}$ inches in diameter when open, scales broad.—Rocky Mts. to Arizona and Washington; also near California boundary on Ashland Butte, Oregon, W.L.J. no. 2573.

2. *P. breweriana* Wats. WEEPING SPRUCE. Singular subalpine tree 20 to 95 feet high; branches clothing the trunk to the ground, few and mainly horizontal, especially in the top, ornamented with cord-like branchlets hanging straight down and thus giving a formal effect to the stiffish and very thin crown; trunk $1\frac{1}{2}$ to $3\frac{1}{2}$ feet in diameter, its bark thin ($\frac{1}{2}$ inch thick), whitish and smoothish on the surface but presenting shallowly concave scars from which have fallen thick scales of irregular shape, mostly 1 to 4 inches long and half as wide; inner bark white, outer bark red-brown; leaves borne all round the stem, $\frac{1}{2}$ to 1 inch long, roundish and green below, whitish above on either side the conspicuous median ridge, obtuse at apex; staminate catkins yellow-brown, 1 inch long; ovulate catkins dark purple, $1\frac{1}{4}$ inches long, with the sides of the scales towards the apex turned up in such a way that the surface of the catkin presents rhomboidal areas; bracts appressed, with finely toothed edges; cones narrowly cylindrical, $3\frac{1}{2}$ to $4\frac{1}{4}$ inches long, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter; scales rounded at apex, very thick for a spruce and with smooth entire edges; bracts oblong, acute, $\frac{1}{5}$ to $\frac{1}{4}$ as long as the scales; seeds $1\frac{1}{2}$ lines long, the wing 4 lines long.

Local subalpine species, favoring cup-like hollows at head of north cañons where the snow-drifts persist until July or later. It ranges from northern Trinity to the western side of Marble Mt. (W.L.J. no. 2847), eastern slope of the Klamath Range (W.L.J. no. 2890), through the Siskiyou, northward to the high mountains south of Rogue River and westward to the Oregon

Coast Range. Singular tree, remarkable for its long slender cord-like branchlets perfectly pendulous from the usually horizontal limbs.

Refs.—*PICEA BREWERIANA* Watson, Proc. Am. Acad. vol. 20, p. 378 (1885), type loc. summit of the Siskiyou on Happy Camp Trail, *Thos. Howell* (1884).

4. **PSEUDOTSUGA** Carr. FALSE SPRUCE.

Large trees with flat, short-petioled leaves, spreading around the stem or on horizontal branches often somewhat 2-ranked. Staminate catkins axillary, the anthers tipped with a spur and opening obliquely. Ovulate catkins erect, terminal or axillary. Cones pendent, maturing in the first autumn; scales thin, rounded, shorter than the slender acutely 2-lobed bracts which bear a spear-like point in the notch. Seeds without resin vesicles; cotyledons 5 to 12.—Three species, 2 in America and 1 in Japan. In botanical relationship it stands in an intermediate position among *Picea*, *Tsuga*, and *Abies*. The general habit and branching, the leaves spreading all around the stem, the medium-sized pendent cones borne all over the tree, the persistent cone-scales, the seed without resin vesicles—in all these features it resembles *Picea*, differing from it most markedly in its bark, which is not thin and scaly, and in its exserted bracts. In its petioled blunt leaves, often pendent leader of very young trees, and persistent cone-scales it is like *Tsuga*. In its roughly fissured thick bark and exserted bracts it resembles *Abies*. Its peculiar cone bracts, signally different from those of any other conifer, and the obliquely dehiscing anthers are the chief marks of the distinctive genus *Pseudotsuga*. (Name from Greek, pseudo, false, and Japanese, *tsuga*, hemlock.)

Cones $1\frac{3}{4}$ to $3\frac{1}{2}$ inches long; bracts conspicuously exserted; Sierra Nevada and Coast Ranges 1. *P. taxifolia*
Cones 4 to $7\frac{1}{2}$ inches long; bracts protruding little; S. California only. 2. *P. macrocarpa*

1. ***P. taxifolia* Britt.** DOUGLAS FIR. DOUGLAS SPRUCE. (Figs. 7 and 8.) Forest tree 70 to 200 feet in height, in dense stands often exhibiting clear trunks 100 to 150 feet high and 4 to 8 feet in diameter; bark on young trees thin, smooth, gray or mottled, sometimes alder-like, on old trunks 1 to $6\frac{1}{2}$ inches thick, soft or putty-like, dark brown, fissured into broad heavy furrows, in cross section showing alternate layers of red and white; branchlets usually drooping, the leaves spreading all around the stem or on horizontal branchlets spreading more or less to right and left but not truly 2-ranked; leaves $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, $\frac{1}{2}$ to 1 line wide, linear, blunt at apex, flat with a median groove above and green, below with 2 pale longitudinal bands and a median ridge, very short-petioled; staminate catkins cone-cylindric, 4 or 5 lines long, exserted from winter buds on a peduncle 2 or 3 lines long and scattered along the under side of the branchlets; pistillate catkins erect, terminal or lateral, 1 inch long, the bracts very conspicuous on account of the small size of the scales at this stage; cones pendulous, long oval and more or less pointed, $1\frac{3}{4}$ to $2\frac{1}{2}$ or $3\frac{1}{2}$ inches long, $1\frac{1}{4}$ to $1\frac{3}{4}$ inches in diameter when open; scales broad and rounded at apex; bracts conspicuously exserted, broadly linear and bearing in the deep notch at apex a spear-like point; seeds 3 lines long, almost as long as the wings; cotyledons 5 to 8.

Sierra Nevada from Mt. Shasta and Lassen Peak southward to Fresno Co. (Stevenson Creek, 3,000 to 5,500 feet). Coast Ranges, from Santa Lucia Mts. (southern limit in California), Santa Cruz Mts., Bolinas Ridge, Inverness Ridge, outer North Coast Range, Mt. Hood and Napa ranges, Upper Cache

Creek, and northward to the Siskiyou; associated with the Redwood in the outer range and with Tan Oak, Madroña, Black Oak and Yellow Pine in the inner ranges. The characteristic "Bald Hills" of Mendocino and Humboldt (inner ranges) with their "opens" and mixed woods of Douglas Fir and the species just mentioned are well shown in Fig. 8. Not in Vaca Mts., Mt. Diablo and Mt. Hamilton ranges nor Oakland Hills (Cf. Jepson, Fl. W. Mid. Cal. 19,—1901). Widely distributed beyond our borders, reaching British Columbia (type loc. Nootka, Archibald Menzies), South Dakota, northern Texas and Mexico. Largest tree of the Pacific Coast next to the Sequoias. Variable in habit of branchlets and hue of foliage. Growth rapid and reproduction strong. Timber unequalled for its strength and lightness and the size of the sticks; well-known in the lumber trade as "Oregon Pine."

Refs.—*PSEUDOTSUGA TAXIFOLIA* Britton, Trans. N. Y. Acad. Sci. vol. 8, p. 74 (1889). *Pinus tarifolia* Lambert, Pinus, vol. 1, p. 51, t. 33 (1803). *Abies douglasii* Lindley, Penny Cycl. vol. 1, p. 32 (1833); Newberry, Pac. R. Rep., vol. 6, pt. 3, pp. 54, 90, pl. 8, fig. 20 (1857). *Pseudotsuga douglasii* Carriere, Traite Conif. ed. 2, p. 256 (1867); Engelman in Bot. Cal. vol. 2, p. 120 (1880).

2. **P. macrocarpa** Mayr. BIG-CONE SPRUCE. Tree 30 to 60 or occasionally 80 feet tall, with very long lower branches; bark, foliage, catkins, and cones very similar to those of the preceding; bark dark or black; leaves slightly curved; cones 4 to 7½ inches long, 2 to 3 inches in diameter when open; bracts protruding little or not at all beyond the scales, except the lowest, the tails of which are often as much as ¾ inch long; cotyledons 6 or 7.

Cañons and north slopes: Tejon Cañon and San Emigdio Mts. westward to the San Rafael and Santa Inez ranges, southward to the Sierra Madre, San Bernardino Mts. (where it reaches its greatest development), Palomar, and Cuyamaca Mts. Recurs on San Pedro Martir in Lower California. Altitudinally it may be considered as a transition species from the upper part of the chaparral to the lower part of the Yellow Pine belt. Adapted to drier conditions than its congener, the Douglas Fir.

Refs.—*PSEUDOTSUGA MACROCARPA* Mayr, Wald. Nordam, p. 278 (1890). *Abies douglasii* var. *macrocarpa* Torrey in Ives, Rep. Colo. River, pt. 4, p. 28 (1860). *Pseudotsuga douglasii* var. *macrocarpa* Engelman in Bot. Cal. vol. 2, p. 120 (1880).

5. **ABIES** Link. FIR.

Highly symmetrical trees of lofty stature, the branches in regular whorls and ramifying laterally, forming flat sprays. Leaves linear, about a line wide, flat or 4-angled, whitened beneath, spreading in two opposite directions or even 2-ranked, or more often curving upwards, leaving a smooth circular scar when they fall; resin canals in ours 2. Catkins from axillary winter buds. Staminate catkins borne on the under side of the branches, mostly in the upper half of the tree; anthers tipped with a knob, their cells opening transversely. Ovulate catkins erect, on the upper side of the topmost spreading branches. Cones erect, maturing in the first autumn, falling to pieces on the tree; scales thin, incurved at the broadened apex; bracts often exserted. Seeds with resin vesicles; cotyledons 4 to 10.—Northern hemisphere, especially in the high mountains or far north, some 23 species; 7 species on the Pacific Coast, 2 of them beyond our borders. (*Abies*, the ancient Latin name.)

Leaves of lower and uppermost branches slightly different.

Cones 2 to 5½ inches long; bracts not exserted.

Leaves glaucous or dull green, flat or on cone-bearing branches keeled above, acute or rarely notched at apex, spreading in two ranks or curving upwards, with a



FIG. 7. *PSEUDOTSUGA TAXIFOLIA* Britt., fruiting branch.

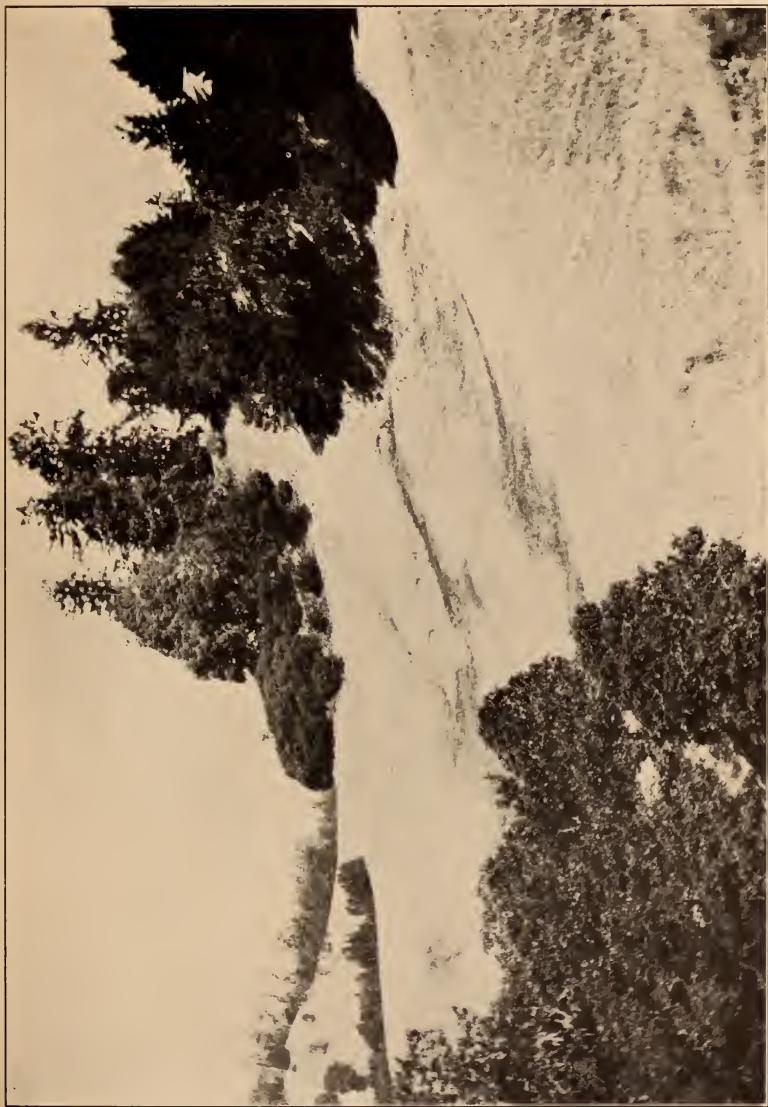


FIG. 8. "BALD HILLS" of Mendocino and Humboldt counties. Clusters of *PSEUDOTSUGA TAXIFOLIA* Britt. and *PASANIA DENSIFLORA* Oerst.; *QUERCUS GARRYANA* Dougl., at lower left hand corner; *UMBELLULARIA CALIFORNICA* Nutt., elump half concealed in head of cañon at left. Characteristic "opens" and wet swales between the groves, the high grass whitened by the midsummer heat.

- twist in the short petiole; old bark roughly and deeply furrowed, drab or grayish; high Sierra and Coast mts.1. *A. concolor*.
 Leaves dark lustrous green, white beneath, notched at apex, usually spreading in two ranks, on cone-bearing branches often blunt, curving upwards; bark white, smooth or fissured into low flat ridges; north coast only.....2. *A. grandis*.
 Cones 4 to 8 inches long, the bracts concealed or exerted; leaves ridged above and below so as to be 4-sided, somewhat compressed, thicker on the uppermost branches, curving upwards but not twisted, sessile; old bark deeply divided into roughly broken ridges, reddish brown; high Sierra and Coast mts.3. *A. magnifica*.
 Cones 4 to 5 inches long, the exerted bracts reflexed, usually concealing the scales; leaves of lower branches flattened, distinctly grooved above; Trinity Summit to Washington.4. *A. nobilis*.
 Leaves alike all over tree; cones with conspicuous bracts, the exerted portion long and bristle-like; bark light brown, smoothish; Santa Lucia Mts. only.....5. *A. venusta*.
1. **A. concolor** Lindl. & Gord. WHITE FIR. (Fig. 9.) Forest tree 60 to 150 or 200 feet high, with a narrow crown composed of flat sprays and a trunk naked for $\frac{1}{3}$ to $\frac{1}{2}$ its height and 1 to 6 feet in diameter; bark smooth,

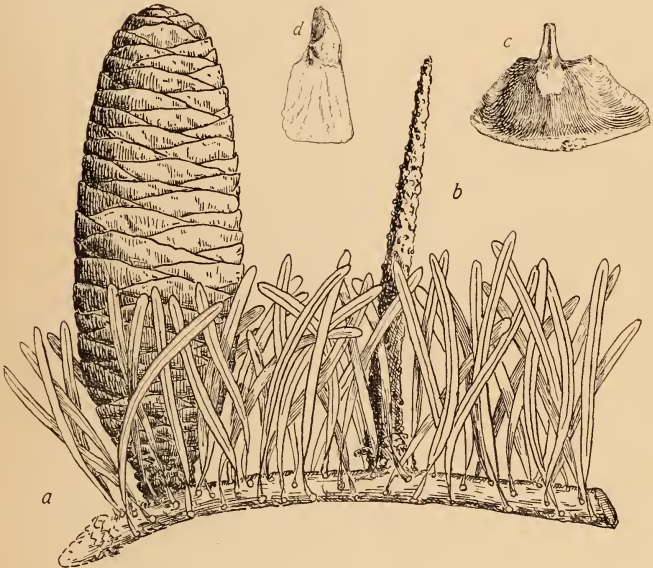


FIG. 9. *ABIES CONCOLOR* Lindl. & Gord., fruiting branch. *a*, Cone; *b*, axis from which scales have fallen; *c*, scale and bract; *d*, seed. nat. size.

silvery or whitish in young trees, becoming thick and heavily fissured into rounded ridges on old trunks and gray or drab-brown in color, in section showing dull brown areas separated by a coarse light-colored mesh; leaves $\frac{1}{2}$ to $2\frac{1}{2}$ (commonly 1 to $1\frac{1}{2}$) inches long, flat, often with a median channel on upper side, or on the uppermost branches keeled, a prominent midrib

beneath with a broad depressed stomatal band on either side, contracted at base into a very short petiole, acutish, obtuse or slightly notched at summit, spreading in two ranks or more or less erect by a twist in the very short petiole; staminate catkins cylindric, straw-yellow or red, $\frac{1}{2}$ inch long or less; cones brown, oblong, rounded at summit and base, 2 to $5\frac{1}{2}$ inches long, 1 to $1\frac{3}{4}$ inches in diameter; scales broad and rounded; bracts about $\frac{1}{2}$ as long as the scales, roundish and finely toothed, often with a notch at top and usually terminating in a short slender point; seeds 5 lines long, the wing 6 or 7 lines long, truncate at the end, 5 or 6 lines wide, widening towards the apex.

Mountain slopes: Sierra Nevada and Coast Ranges, north to southern Oregon, east to Colorado and New Mexico, south into Lower California. One of the four most abundant forest trees in the main timber belt of the Sierra Nevada, chiefly between 3,500 and 7,500 feet in the north and 5,000 and 8,300 feet in the south. High North Coast Ranges from the Siskiyou and Marble Mt. (where it is abundant) south along the Yollo Bolly range to Snow Mt., thence a gap of 360 miles to Mt. Pinos and the San Rafael Mts. in South Coast Ranges. Abundant on the summits of the mountains of Southern California (5,000 to 11,500 feet). Makes second grade saw-timber, useful for fruit boxes and ordinary construction. Also, but wrongly, called Silver Fir.

Refs.—*ABIES CONCOLOR* Lindl. & Gord., Jour. Hort. Soc. Lond. vol. 5, p. 210 (1850), the type from near Santa Fe, New Mexico, Aug. Fendler. *A. lowiana* Murray, Proc. R. Hort. Soc. vol. 3, p. 317, figs. (1863).

A. *LASIOCARPA* Nuttall. Alpine Fir. Related to preceding; cones $2\frac{1}{2}$ to 4 inches long, the rounded or emarginate bracts with long slender but not exerted tips.—Rocky and Cascade mountains to Alaska.

A. *AMABILIS* Forbes. Amabilis Fir. Cones $3\frac{1}{2}$ to 6 inches long, the slender-tipped bracts $\frac{1}{2}$ as long as scales.—Cascade Mts.

2. A. *grandis* Lindl. LOWLAND FIR. Forest tree 40 to 160 or rarely 275 feet high with horizontal branches, the trunk 1 to 3 feet in diameter and vested in a white or light brown bark which is very smooth or shallowly broken into low flat ridges; in section the inner bark light brown, the outer bark dark red with a mesh of purple lines running through it; horizontal branches with the leaves spreading by a twist at base in two ranks and so making a flat spray, or in any event tending to right and left, those originating on top of the stem having the peculiarity of being much shorter than those coming from the sides; leaves flat, 1 to 2 inches long, notched at apex, the upper side dark lustrous green and with a median channel, the lower side with two white bands separated by a ridge; staminate catkins straw-color, cylindric, 5 or 6 lines long, borne on a peduncle 3 or 4 lines long, the crest of the anthers mostly 2-toothed; ovulate catkins borne in upper half of the tree; cones long-oblong in outline, $2\frac{1}{2}$ to 4 inches long, $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter; scales with a broad rounded summit, and narrow stalk-like base, broader than long; bracts very small, with a short awl-like point set on the roundish apex, half as long as the scales; seeds drab-color, $4\frac{1}{2}$ lines long with a wing somewhat longer and twice as broad.

North Coast Ranges, along ocean bluffs or scattered through the Redwood Belt, from near Fort Ross on the Sonoma coast northward and far northward to Oregon and Washington where it is abundant and attains its best development. In California it grows to greatest size in association with the Redwood

east of Crescent City. Wood markedly odorous (whence "Stinking Fir"), producing a second grade lumber.

Refs.—*ABIES GRANDIS* Lindley, Penny Cycl. vol. 1, p. 30 (1833), type loc. mouth of Columbia River, *Douglas*; Sheldon, *For. Wealth Oreg.* p. 16 (1904).

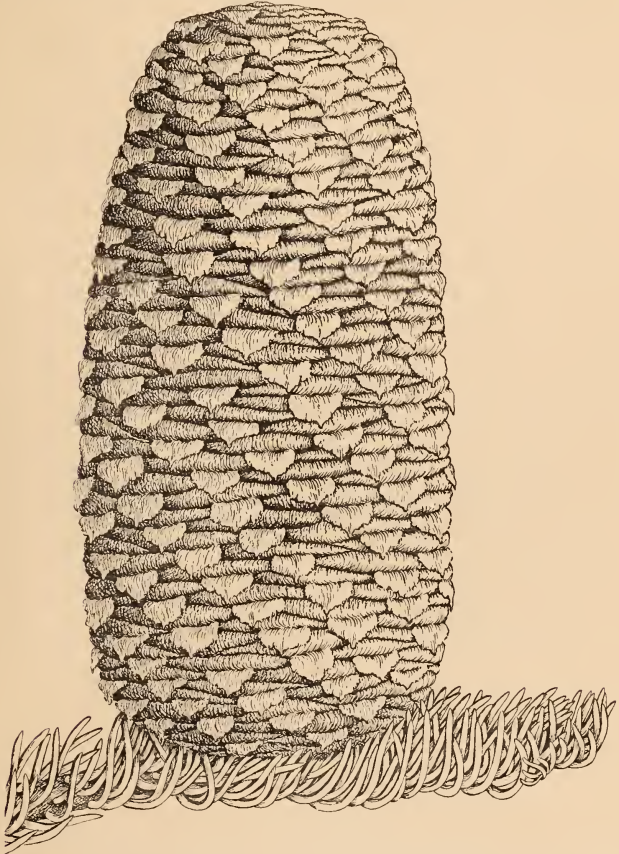


FIG. 10. *ABIES MAGNIFICA* Murr., the form with exserted reflexed bracts (*VAR. SHASTENSIS* Lemmon). The ordinary form bears similar cones but the bracts not visible. nat. size.

3. *A. magnifica* Murray. RED FIR. (Fig. 10.) Forest tree 60 to 175 or even 200 feet high, with a trunk 1 to 5 feet in diameter and a very narrow or cone-shaped crown composed of numerous horizontal strata of fan-shaped

sprays; bark on young trees whitish or silvery, on old trunks dark red, very deeply and roughly fissured, in section showing reddish brown areas set off by a sharply defined purple mesh; leaves $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, ridged above and below so as to be equally 4-sided, although more or less compressed, not contracted at base or scarcely so, acutish at apex, those on the under side of the branches spreading right and left, in the top of the tree more thickened, erect, incurved and hiding the upper side of the branch; staminate catkins dark red, about 3 lines long; cones, when young, beautiful dull purple objects, becoming brown when mature, 4 to 8 inches long, $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in diameter, broadly oval in outline, the broad scales with upturned edges; bracts very variable in form and length, sometimes concealed beneath the scales, sometimes conspicuously exerted and reflexed, their terminal portion commonly transversely oblong, or broad with a short spreading awl-like point or pointless; seeds 7 lines long with a semi-flabelliform wing 8 lines long and 8 to 11 lines broad; cotyledons 9 to 13.

Mountain slopes and ridges: Sierra Nevada, 5,000 to 8,500 feet, from the Greenhorn Mts. northward to Lassen Peak and Mt. Shasta; thence ranging into southern Oregon, westward to Marble Mt., and southward along the Yollo Bolly range as far as Mt. Hull and Snow Mt. Wood straight, fine-grained, heavy and very durable. Large sticks from this tree are used as shaft timbers in Sierra Nevada gold mines. The most beautiful tree in the upper portion of the main timber belt of the Sierras.

Refs.—*ABIES MAGNIFICA* Murray, Proc. R. Hort. Soc. vol. 3, p. 318, f. 25-33 (1863), type loc. central Sierra Nevada; first discovered by Capt. J. C. Fremont. *A. nobilis* var. *magnifica* Kellogg, For. Trees Cal. p. 29 (1882); Masters, Jour. Linn. Soc. vol. 22, pp. 187, 189, figs. 20, 21 (1886).

4. *A. nobilis* Lindl. NOBLE FIR. Forest tree 80 to 250 feet high, with slender branchlets and roughly broken trunk bark; leaves on the lower branches flat, sharply and deeply grooved above, on upper branches rounded above and obscurely ridged below, erect, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; cones oblong-cylindrical, 4 to 5 inches long, 2 to $2\frac{1}{2}$ inches in diameter; scales surpassed and often wholly concealed by the reflexed spatulate bracts which are rounded and fimbriate and tipped with an awl-like point.

Coast Ranges and Cascades of Washington and Oregon, ranging south to the Siskiyou Mts. in southern Oregon and to Trinity Summit in California (W.L.J. no. 2079).

Refs.—*ABIES NOBILIS* Lindley, Penny Cycl. vol. 1, p. 30 (1833), type loc. Cascade Mts. just south of Columbia River, Douglas.

5. *A. venusta* Koch. SANTA LUCIA FIR. (Fig. 11.) Singular montane tree 30 to 75 or 100 feet high with a narrow crown abruptly tapering above into a steeple-like top; trunk $\frac{1}{2}$ to $2\frac{1}{2}$ feet in diameter, vested in light reddish brown bark, and bearing short slender declined or drooping branches nearly or quite to the ground; leaves stiff, sharp-pointed, dark green and nearly flat above, below with a white band on either side of the strong median ridge, $1\frac{1}{4}$ or mostly $1\frac{3}{4}$ to $2\frac{1}{4}$ inches long, 1 to $1\frac{1}{2}$ lines wide, mostly 2-ranked; staminate catkins yellowish, fading reddish, broadly cylindrical, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; ovulate catkins broadly oblong in outline, yellowish green, 1 to $1\frac{1}{2}$ inches long; cones elliptic-oblong, $2\frac{1}{2}$ to 4 inches long, $1\frac{1}{2}$ to 2 inches thick, borne on peduncles $\frac{1}{2}$ inch long which arise from a rosette-like cluster of broad thin scales of the winter bud; bracts wedge-shaped, truncate or

notched at summit, the midribs prolonged into a long-exserted bristle $\frac{1}{2}$ to $1\frac{3}{4}$ inches long and $\frac{1}{2}$ line wide; seeds reddish brown, $3\frac{1}{2}$ lines long with a broad wing 4 to 5 lines long and rounded at apex.

Rocky mountain peaks and deep cañons, Santa Lucia Mts. Not found elsewhere. The known localities in the range from north to south are as follows: 1. Big Sur Cañon. 2. Millers Cañon, on watershed of the Carmel River. 3. Arroyo Seco Cañon. 4. Twin Peaks and Cone Peak. 5. Cañon near Los Potranchos. 6. Cañada de Los Potranchos. 7. Bear Cañon near Punta Gorda. 8. Villa Cañon. 9. San Carpofofo Cañon. Restricted in



FIG. 11. *ABIES VENUSTA* Koch, remarkable for its long sharp-pointed leaves and long bristly bracts. *a*, Cone-bearing branchlet; *b*, scale and bract; *c*, seed. nat. size.

range and also isolated from all other species in the genus, there being no other fir within 225 miles to the north, 140 miles to the east and 120 miles southeasterly.

Refs.—*ABIES VENUSTA* Koch, Dendr. vol. 2, pt. 2, p. 210 (1873). *Pinus venusta* Douglas, Comp. Bot. Mag. vol. 2, p. 152 (1836). *P. bracteata* Don, Trans. Linn. Soc. vol. 17, p. 442 (1837). *Abies bracteata* Nuttall, Sylva, vol. 3, p. 137, t. 118 (1842); Engelmann in Bot. Cal. vol. 2, p. 118 (1880).

TAXODIACEAE. REDWOOD FAMILY.

Trees with linear or awl-shaped alternate leaves. Staminate and ovulate catkins on the same tree. Staminate catkins small and cone-like. Scales of the ovulate catkins spirally arranged, more or less blended with the bract, often

spreading horizontally from the axis of the cone and developed into broad flattish summits. Ovules to each scale 2 to 9. Seeds not winged or merely margined.—Seven genera, widely scattered over the earth, each with 1 to 3 species. *Taxodium* (Bald Cypress), *Cryptomeria* (Japan Cedar), *Cunninghamia*, and *Seiadopitys* (Umbrella Pine) are cultivated in California.

Bibliog.—Gray, *Sequoia and Its History* (Proc. Am. Assoc. Adv. Sci. vol. 21, p. 1,—1872; Sci. Pap. vol. 2, p. 142,—1889). Big Tree, U. S. Div. For. Bull. no. 28 (1900). Redwood, U. S. Bur. For. Bull. no. 38 (1903).

SEQUOIA Endl. REDWOOD.

Tall trees with thick red fibrous bark and linear, awl-shaped, or scale-like leaves. Staminate catkins terminal, with many spirally disposed stamens, each bearing 2 to 5 pollen sacs. Ovulate catkins terminal, composed of many spirally arranged scales, each with 5 to 7 ovules at base. Cone woody, its scales divergent at right angles to the axis, widening upward and forming a broad rhomboidal wrinkled summit with a depressed center. Seeds flattened; cotyledons 4 to 6.—Two species. (*Sequoia*, a chief of the Cherokees, who invented an alphabet for his tribe.)

Leaves awl-shaped, ascending all around stem; cones 2 to $3\frac{3}{4}$ inches long; Sierra Nevada only1. *S. gigantea*.

Leaves linear, petioled, spreading in 2 ranks and forming a flat spray; cones $\frac{5}{8}$ to $1\frac{1}{8}$ inches long; Coast Ranges only2. *S. sempervirens*.

1. *S. gigantea* Dec. BIG TREE. Giant tree 100 to 325 feet high with columns 80 to 225 feet to the first limb and 5 to 30 feet in diameter at 6 feet above the ground; crown rounded at summit or much broken in age; bark red, deeply furrowed or fluted, $\frac{1}{2}$ to 2 feet thick; leaves awl-like, 1 to 6 lines long, only the tips free, adherent below to the stem which they thickly clothe; cones maturing in the second autumn, red-brown, ovoid, 2 to $3\frac{3}{4}$ inches long, composed of 35 to 40 scales; scales with transversely rhomboidal summits and a centrally depressed umbo; seeds numerous, flattened, margined all around with a wing, ovate or oblong in outline, $2\frac{1}{2}$ to 3 lines long.

Western slope of the Sierra Nevada, 5,000 to 8,000 feet, from Placer Co. southward to Tulare Co., a longitudinal range of 250 miles but occurring in more or less widely disconnected and limited areas called "groves," thirty-two in number. The northern groves, i. e., north of King's River, are widely separated; the southern groves are less widely separated or even connected by scattered individuals and form an interrupted belt.

The north groves are as follows: 1. NORTH GROVE, Placer Co., 10 miles east of Michigan Bluff, 6 trees. 2. CALAVERAS GROVE (type loc., Wm. Lobb), 51 acres, 101 trees. 3. STANISLAUS GROVE, 6 miles southeast of Calaveras Grove, 1,000 acres, 1,380 trees. 4. TUOLUMNE GROVE, "Big Oak Flat"—Yosemite stage road, $1\frac{1}{2}$ miles northwest of Crane Flat, 10 acres, 40 trees. 5. MERCED GROVE, Coulterville-Yosemite wagon road, 3 miles from Hazel Green, 20 acres, 33 trees. 6. MARIPOSA GROVE, in Yosemite National Park, near Wawona, really consisting of two groves, 365 trees in upper grove, 182 trees in lower grove, one of these being the "Grizzly Giant"; 125 acres. 7. FRESNO GROVE, in Madera Co., near north line, 2,500 acres, 1,500 trees; many trees lumbered.

The south groves are as follows: 8. DINKEY GROVE, in Sierra National Forest, Fresno Co., 50 acres, 170 trees. 9. CONVERSE BASIN FOREST, Kings

River, Fresno Co., 5,000 acres, 12,000 trees; almost entirely lumbered. 10. BOULDER CREEK FOREST, Kings River, Fresno Co., 3,200 acres, 6,450 trees; more or less lumbered. 11. GENERAL GRANT FOREST, near Millwood, Fresno Co., about 2,500 acres, 250 trees. 12. REDWOOD CAÑON FOREST, Redwood and Eshom creeks, Tulare Co., 3,000 acres, 15,000 trees. 13. NORTH KAWEAH FOREST, North Fork Kaweah River, 500 acres, 800 trees. 14. SWANEE RIVER GROVE, on Swanee River branch of Marble Fork Kaweah River, 20 acres, 129 trees. 15. GIANT FOREST, Marble Fork Kaweah River, 8,000 acres, 20,000 trees, about 5,000 large ones. 16. REDWOOD MEADOW GROVE, Middle Fork Kaweah River, 50 acres, 200 trees. 17. HARMON MEADOW GROVE, Middle Fork Kaweah River, 10 acres, 80 trees. 18. ATWELL FOREST, both sides of East Fork Kaweah River, 3 miles west of Mineral King, 1,500 acres, 3,000 trees; in large part lumbered. 19. LAKE CAÑON GROVE, East Fork Kaweah River, 20 acres, 80 trees. 20. MULE GULCH GROVE, East Fork Kaweah River, 25 acres, 70 trees. 21. HOMER'S PEAK FOREST, East Fork Kaweah River, 5,500 acres, 1,500 trees. 22. SOUTH KAWEAH FOREST, South Fork Kaweah River, 160 acres, 300 trees. 23. DILLON FOREST, North Fork Tule River, 3,600 acres, 3,500 trees; large part lumbered. 24. TULE RIVER FOREST, Middle Fork Tule River, 15,000 acres, 5,000 trees; large part lumbered. 25. PIXLEY GROVE, Middle Fork Tule River, 850 acres, 500 trees. 26. FLEITZ FOREST, Middle Fork Tule River, 4,000 acres, 1,500 trees. 27. PUTNAM MILL FOREST, Middle Fork Tule River, 4,000 acres, 900 trees. 28. KESSING GROVES, South Fork Tule River, 2,800 acres, 700 trees. 29. INDIAN RESERVATION GROVE, South Fork Tule River, 1,500 acres, 350 trees. 30. DEER CREEK GROVE, South Fork Deer Creek, 300 acres, 100 trees. 31. FREEMAN VALLEY FOREST, Kern River Basin, 1,000 acres, 400 trees. 32. KERN RIVER GROVES, Kern River Basin, 700 acres, 200 trees.

Big Tree prefers slopes, ridges or depressions where there is sufficient moisture but it may grow in bare granite as in Giant Forest. Commonly associated with White Fir, Incense Cedar, Yellow Pine and Sugar Pine. Reproduction fair in southern groves, especially on burned areas, mostly at a standstill in northern groves. Young trees of pyramidal outline with branches nearly or quite to ground; middle-aged trees clear of branches for 50 to 175 feet and with rounded summit to the crown; aged trees with broken crown, dead tip to axis, and more or less shattered side branches. Extreme age, 1,100 to 2,400 years. Wood similar to that of Redwood but more brittle, pink when freshly sawn.

Refs.—*SEQUOIA GIGANTEA* Decaisne, Bull. Soc. Bot. Fr. vol. 1, p. 70 (1854); Shinn, Gard. & For., vol. 2, p. 614 (1889); Walker, Zoe, vol. 1, p. 193 (1890); Jepson in Elwes & Henry, Trees of Great Britain and Ireland, vol. 3, p. 704 (1908). *Wellingtonia gigantea* Lindley, Gard. Chron. 1853, p. 823. *Sequoia wellingtonia* Seeman, Bonplandia, vol. 3, p. 27 (1855); Sargent, Silva N. Am. vol. 10, p. 145, t. 536 (1896). Mammoth Trees, Williamson, Pac. R. Rep. vol. 5, p. 257, pl. 13 (1856).

2. *S. sempervirens* Endl. REDWOOD. (Figs. 12 and 13.) Tall tree 100 to 340 feet in height, with narrow crown, the branches horizontal or sweeping downward, especially the lower ones; bark cinnamon-red and fibrous, 3 inches to 2 feet thick; foliage reddish brown; leaves linear, spreading right and left so as to form flat sprays, $\frac{1}{4}$ to $1\frac{1}{4}$ (mostly $\frac{1}{2}$ to $\frac{3}{4}$) inches long and 1 to $1\frac{1}{4}$ lines wide, or in the top of adult trees with short linear or awl-shaped leaves 1 to 5 lines long and strikingly similar to those of the preceding;

staminate catkins 3 lines long, with ovate crests and 4 pollen-sacs; cones oval, reddish brown, $\frac{5}{8}$ to $1\frac{1}{8}$ inches long and $\frac{5}{8}$ to $\frac{7}{8}$ inch broad, borne abundantly on the ends of branchlets mostly in the top of the tree, maturing in first autumn; scales 14 to 26; seeds narrowly margined, elliptic in outline, 2 lines long.

Fog belt of the California coast from the Santa Lucia Mts. northward to southwestern Oregon, forming an interrupted belt 450 miles long and 1 to 40 miles wide, most abundant on the western slope of the outer Coast Range. The two main bodies of Redwood occur in the North Coast Ranges north of the southern Sonoma line: 1. Humboldt-Del Norte area, the densest and most highly developed area, begins on Smith River, Del Norte Co., and extends southward through Humboldt forming splendid timber stands on Mad, Van Duzen, and main Eel rivers, but recedes from the coast just south of Eureka and follows the south fork of Eel River inland as far south as the vicinity of Philipsville. Excepting a few scattered patches, as at Briceland and White Thorn, there is a transverse break in the Redwood Belt in southern Humboldt Co. 2. Mendocino-Sonoma area, begins near the north line of Mendocino Co., follows the outer Coast Range southward as far as southern Sonoma (near Freestone), ranging inland to Willits, Cloverdale and Napa Valley and even crossing the Napa Range to the eastern slope of Howell Mt., the easternmost locality, 40 miles from the sea and on the watershed of the Sacramento River (Cf. Jepson, Fl. W. Mid. Cal. p. 24,—1901). South of Sonoma Co., the Redwood occurs in isolated or restricted areas as follows: Tocaloma to Mill Valley and Muir Woods in Marin Co.; Redwood Peak, Redwood Cañon and headwaters of San Leandro Creek in the Oakland Hills; Santa Cruz Mts., from near Half-Moon Bay to south bank of Pajaro River in San Benito Co., and east to Los Gatos, Norton and Saratoga cañons (lower limits 700 to 1,500 feet) and Palo Alto; Santa Lucia Mts., seaward slope from Tobie Dow's ranch to Salmon Creek Cañon (southernmost locality), chiefly confined to the narrow deep cañons. There are three groves in Oregon a few miles north of the California line. (Type loc. Santa Cruz, Menzies.)

Seed abundant but seed reproduction weak; reproducing abundantly and persistently by stump sprouts which form the barrier of poles or trees about an old stump known as a "Redwood circle." Mature trees are 500 to 1,400 years old. Its most common associates are Tan Oak, Douglas Fir, and Madroña, with a tangle of Huckleberry, Salal, and Thimbleberry on the forest floor. The yield is 10,000 to 60,000 feet board measure to the acre, but in Humboldt and Del Norte large areas on the river flats, nearly or quite pure, often yield 100,000 to 150,000 feet per acre, or sometimes as much as 400,000 feet; a yield of $2\frac{1}{2}$ million feet to the acre has been recorded. Wood light, soft, exceedingly straight and often fine-grained and used for numerous purposes in the California industries. Redwood lumber in this State has been of incalculable value in railroad, telegraph and dwelling construction, manufacturing, and general farm purposes. California might have spared her gold mines but not the resources of the Redwood Belt.

Refs.—*SEQUOIA SEMPERVIRENS* Endlicher, Syn. Con. p. 198 (1847); Purdy, Gard. and For. vol. 3, p. 235 (1890); Gibbons, Erythraea, vol. 1, p. 161 (1893); Peirce, Proc. Cal. Acad. ser. 3, Bot. vol. 2, p. 83 (1901). *Taxodium sempervirens* Lambert, Pinus, vol. 2, p. 24, t. 7 (1828). *Sequoia gigantea* Endlicher, Syn. Conif. p. 198 (1847). Redwood, Nordhoff, N. Cal. Ore. & Sandwich Isl. p. 168 (1877); Sargent, Gard. & For. vol. 10, p. 41 (1897).



FIG. 12. *SEQUOIA SEMPERVIRENS* Endl. Virgin stand, Humboldt County, sealing 300,000 feet B. M. to the acre. Characteristic dense undergrowth of *WOODWARDIA*, *VACCINIUM* and other shrubs.



FIG. 13. *SEQUOIA SEMPERVIRENS* Endl. Logging in the Vance Woods near Eureka; butt log in foreground 17 x 19 feet, from a tree which measured 150 feet to first limb.

CUPRESSACEAE. CYPRESS FAMILY.

Trees or shrubs with opposite or whorled scale-like (or rarely linear) leaves thickly clothing the ultimate branchlets. Stamens and ovules in separate catkins terminal on the branchlets. Staminate catkins small, with shield-like stamens bearing 2 to 6 pollen-sacs. Ovulate catkins consisting of several opposite or whorled scales which bear at base 1 to several erect ovules. Cones dry or berry-like, of few scales; "scales" consisting (morphologically) of a completely blended scale and bract.—Nine genera, widely distributed over the earth. *Thujopsis* (Japanese *Arborvitæ*) is in cultivation with us.

Bibliog:—Hooker, J. D., *Monterey Cypress* (Gard. Chron. 1885, p. 176, fig.). Masters, M. T., *A General View of the Genus Cupressus* (Jour. Linn. Soc. vol. 31, p. 312,—1896).

Fruit a woody cone; stamens and ovules on same tree.

Branchlets flattened, disposed in flat sprays; leaves opposite, in 4 rows, the successive pairs unlike; cones maturing in first autumn; seeds 2 to each scale.

Scales of cones imbricated.

Cones pendent, scales 6, only the middle pair seed-bearing; seeds unequally 2-winged.1. *LIBOCEDRUS*.

Cones reflexed, scales 8 to 12, the 2 or 3 middle pair seed-bearing; seeds equally winged.2. *THUJA*.

Scales of cones peltate; seeds narrowly winged3. *CHAMAECYPARIS*.

Branchlets cord-like, not in flat sprays; leaves opposite, in 4 rows, alike; cones maturing in second autumn; seeds acutely margined, many to each scale....4. *CUPRESSUS*.

Fruit a berry; seeds 1 to 3 to each fruit; stamens and ovules on different trees; branchlets cord-like; leaves in whorls of 3 or opposite5. *JUNIPERUS*.

1. *LIBOCEDRUS* Endl. INCENSE CEDAR.

Aromatic trees with flattened branchlets disposed in one plane. Leaves scale-like, opposite, imbricated in 4 rows, the successive pairs unlike. Staminate and ovulate catkins terminal on separate branchlets. Staminate catkins with 12 to 16 decussately opposite stamens, each bearing 4 to 6 pollen-sacs. Ovulate catkins consisting of 6 scales with 2 ovules at the base of each. Cone maturing in one season, oblong, composed of 6 imbricated oblong scales, only the middle pair fertile. Seeds unequally 2-winged; cotyledons 2.—Eight species, 1 on the Pacific Coast of North America, 2 in Chile and 5 in the region from southwestern China to New Zealand. (Libas, a drop—of resin—and *Cedrus*, cedar.)

1. *L. decurrens* Torr. INCENSE CEDAR. Forest tree 50 to 150 feet high with the strongly conical trunk very thick at base (1 to 6 feet in diameter) and gradually diminishing in size upwards; bark thick, red-brown, loose and fibrous, in age broken into prominent heavy longitudinal furrows; ultimate branchlets alternate, numerous, forming flattish sprays and clothed with adherent leaves as if jointed; leaves 1 to 4 lines long, in four ranks and in opposite pairs, coherent, adherent to the stem and free only at tips, those above and below obtuse but minutely pointed and forming a pair overlapped by the keel-shaped lateral pair; staminate catkins $1\frac{1}{2}$ to 2 lines long, the pollen-sacs usually 5 to each scale which ends in a broad roundish crest; ovulate catkins borne singly at the ends of branchlets; cones red-brown, oblong-ovate when closed, $\frac{3}{4}$ to 1 inch long, consisting of 2 seed-bearing scales with 3 (apparently 1) sterile scales between them and often with 2 supplementary ones at base; seed-bearing scales broad and flattish but not thin; all the scales with a small triangular umbo at tip; seeds 4 lines long, margined on each side from

near the base to the apex by two very unequal wings; larger wing elliptical in outline and nearly as long as the scale.

Mountain slopes, cañons and plateaus. Sierra Nevada and Coast Ranges, northward in the Oregon Cascades to Mt. Hood, southward to all the higher ranges of Southern California and into Lower California. Attains its best development in the Sierra Nevada where it flourishes chiefly between 3,500 and 7,000 feet and is one of the four most abundant timber trees (Cf. description Yellow Pine). In the South Coast Ranges it occurs on the San Rafael, San Carlos and Santa Lucia ranges, but is not known from the Gabilan, Mt. Hamilton, Mt. Diablo and Santa Cruz ranges. In the North Coast Ranges it is found on Marble Mt. and Trinity Summit and from Weaverville southward along the Yollo Bolly and Mayacamas ranges as far as the neighborhood of Mt. St. Helena. Reproduces itself aggressively. Wood aromatic, reddish brown, close-grained, exceedingly durable. Also called Post Cedar, Red Cedar, White Cedar and Bastard Cedar.

Refs.—*LIBOCEDRUS DECURRENS* Torrey, Pl. Frem. p. 7, pl. 3 (1853), type loc. headwaters of the Sacramento River, *Fremont*; Jepson, Fl. W. Mid. Cal. p. 24 (1901).

2. *THUYA* L. ARBOR-VITAE.

Aromatic trees with scattered branches, the flattened branchlets disposed in one plane. Leaves scale-like, opposite, and imbricated in 4 rows, the successive pairs unlike, adnate with free tips. Catkins terminal. Staminate catkins with 4 to 6 stamens, each with 3 or 4 anther-cells under the subpeltate crests. Ovulate catkins with 8 to 12 erect scales, each with 2 erect ovules at base. Cones small, maturing the first autumn, reflexed; scales 8 to 12, thin-leathery, the lowest and uppermost pairs sterile. Seeds bordered by nearly equal lateral wings so as to be nearly round, their coats with minute resin-cells; cotyledons 2.—Four species, 2 in North America, and 2 in China and Japan. (Ancient Greek name for a resinous tree.)

1. *T. plicata* Don. CANOE CEDAR. Giant tree 80 to 190 feet high, of pyramidal outline, slender branches, drooping sprays and whip-like often nodding leader; trunk 3 to 16 feet in diameter at the ground but tapering rapidly above the base; bark cinnamon-red; branchlets repeatedly 2-ranked, forming flat sprays, thickly clothed with leaves which conceal the stem; leaves minute, in opposite pairs and of 2 kinds, those on the margin of the flat sprays keeled and acute at tip, those above and below flattish and triangular at apex; cones borne on short lateral branchlets, on opening turned downward beneath the spray, cinnamon color, oblong in outline when closed, $\frac{1}{2}$ inch long; scales 9, the outer ones oblong or obovate, and much broader than the narrow inner ones; seeds winged all around and with a narrow notch at apex, the whole structure 3 lines long.

Outer Coast Range from the Bear River Mts. of Humboldt Co. northward along the coast of Oregon and Washington to southeastern Alaska, eastward to the Cascades, northern Idaho and Montana. Long attributed to Mendocino Co., but no exact station on record. Trees occur sparingly in California, and only 50 to 80 feet high. Wood aromatic, light, soft, remarkably durable, extensively manufactured into shingles. The northern coast Indians hewed their long war canoes out of a single log, wove the fibrous bark into clothing and made dwellings and household utensils out of the wood. Also called Oregon or Red Cedar.

Refs.—*THUJA PLICATA* Don in Lambert, *Pinus*, vol. 2, p. 19 (1824), type loc. Vancouver Island. *Archibald Menzies*; Sudworth, Rep. U. S. Dep. Agr. 1892, p. 328. *T. gigantea* Nuttall, Jour. Phil. Acad. vol. 7, pt. 1, p. 52 (1834); Engelmann in Bot. Cal. vol. 2, p. 115 (1880).

3. CHAMAECYPARIS Spach.

Trees or shrubs; leading shoot nodding; branchlets more or less flattened and in flat sprays; leaves opposite, in 4 rows, the successive pairs in ours unlike. Catkins and cones very similar to *Cupressus*. Stamens with usually 2 pollen-sacs. Ovules 2 to 5 at the base of each scale, the seeds winged, usually 2 (1 to 5). Cones maturing in the first autumn. Cotyledons 2.—Six species, 3 in North America and 3 in Japan. (Greek *chamai*, dwarf, and *kuparissos*, cypress.)

1. *C. lawsoniana* Parl. PORT ORFORD CEDAR. LAWSON CYPRESS. Forest tree 80 to 175 feet high, with straight shafts and narrow pyramidal crown of drooping branches ending in broad flat drooping fern-like sprays; bark brown or somewhat reddish, smooth on young trees, later parting on the surface into large loose thin shreds and finally in adult trees fissured longitudinally with the furrows continuous and separated by flat ridges; foliage fragrant; leaves adpressed, scale-like, thickly clothing the branchlets, disposed in opposite pairs, those above and below rhomboidal, glandular-pitted, and overlapped by the keel-shaped ones on the margin; staminate catkins crimson; cones globose, consisting of about 7 scales, 3 to 4 lines long; seeds $1\frac{1}{2}$ to 2 lines long, narrowly wing-margined on each edge, the whole structure orbicular.

Moist hillsides or cañon bottoms from Coos Bay, Oregon, southward to Mad River and eastward to Halls Gulch, Trinity Co., and the Sacramento River Cañon from Slate Creek to Shasta Springs. Occurs in California only in isolated patches as at Quartz Creek and Shelly Creek bottom (Del Norte Co.), Klamath Range near Preston Peak, Three Creeks near Hupa Valley (W.L.J.), Trinity Center, and upper Trinity River between Coffee Creek and Scott Mts., with a few trees on Graves Creek (Benj. Macomber). The tallest of all cypresses. Wood very fine-grained, faint yellowish white, somewhat aromatic, highly valued as a cabinet wood but the supply limited. Also called Ginger Pine.

Refs.—*CHAMAECYPARIS LAWSONIANA* Parlature in DeCandolle, *Prodromus*, vol. 16, pt. 2, p. 464 (1868). *Cupressus lawsoniana* Murray, Edin. New. Phil. Jour. n. ser. vol. 1, p. 292, t. 9 (1855). Type loc. Sacramento River Cañon, *Wm. Murray*, 1856.

C. NOOTKATENSIS Spach. Nootka Cedar. Yellow Cypress. Bark thin, irregularly fissured into flat ridges; branchlets not flattened; leaves alike, usually not glandular.—Northern Oregon to Alaska.

4. CUPRESSUS L. CYPRESS.

Trees or shrubs with the leaves small and appressed, scale-shaped and closely imbricated in 4 ranks on the ultimate branchlets, or awl-shaped on vigorous shoots. Staminate catkins terminal on the branchlets, with 3 to 5 pollen-sacs to each stamen. Ovulate catkins upon short lateral branchlets, the ovules numerous, erect, in several rows at the base of the scales. Cones globose to oblong, maturing in the second year, the shield-shaped scales fitting closely together by their margins, not overlapping, separating at maturity, their broad summits with a central boss or short point. Seeds acutely angled or with a narrow hard wing; cotyledons 2 to 5.—Northern hemisphere, 14 species. (Ancient Latin name from Greek, *kuparissos*.)

Umbos low, crescent-shaped, upwardly impressed.

Glands on leaves none or rare; maritime species.

Seed small, black1. *C. goveniana*.

Seed larger, brown2. *C. macrocarpa*.

Glands on leaves present as dorsal pits; seeds brown.....3. *C. sargentii*.

Umbos conical, well-developed, spreading; leaves with conspicuous resin-bearing pits.

Cones red-brown, 5 to 8 lines long; umbos typically incurved.....4. *C. macnabiana*.

Cones silvery or glaucous, 4 to 6 lines long; umbos short conical.....5. *C. bakerii*.

1. **C. goveniana** Gord. GOWEN CYPRESS. DWARF CYPRESS. Small shrub 1 to 20 feet high, rarely becoming a tree 75 feet high with the trunk bark brown, smoothish but superficially checked into freely interlocking ribbons $\frac{3}{4}$ inch broad; leaves without pits, rarely with lateral depressions; cones light brown, subglobose or oval, 6 to 8 lines long, rarely larger, with 4 pair of scales; umbo short, thin-edged, upwardly impressed; seeds black, angular or acutely margined, sometimes minutely warty, 1 to $1\frac{1}{2}$ lines long.

Neighborhood of the ocean: Monterey (type loc., Theo. Hartweg); Mendocino White Plains from Mendocino City north to Ft. Bragg. Miniature forests are found on the Mendocino White Plains, where the alkaline soil rests on a sandstone hardpan 1 or 2 feet below the surface; these tiny forests consist of dwarf canes 1 to 5 feet high, unbranched or with only a few short foliage branchlets, and are a remarkable feature of the region. Bushy shrubs 6 to 12 feet high and slender poles 15 to 25 feet high also occur in the same locality, as well as a few trees 50 to 75 feet high and $2\frac{1}{2}$ to 3 feet in trunk diameter. At Monterey hundreds of cone-bearing dwarfs 1 to 2 feet high are scattered in the forest which extends southward and westward from Huckleberry Hill.

Refs.—CUPRESSUS GOVENIANA Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 295 (1849). *C. goveniana* var. *pygmaea* Lemmon, Handb. West. Am. Conif., p. 77 (1895). *C. pygmaea* Sargent, Bot. Gaz. vol. 31, p. 239 (1901). *C. goveniana* var. *parva* Lemmon, Sierra Club Bull. vol. 4, p. 116 (1902).

2. **C. macrocarpa** Hartw. MONTEREY CYPRESS. Littoral tree 15 to 20 feet high with trunk 1 to 3 feet in diameter; crown regular, conical, or when wind-blown exceedingly distorted and irregular; ultimate branchlets numerous, fine and terete, densely clothed with triangular scale-like leaves; leaves $\frac{1}{2}$ to $1\frac{1}{2}$ lines long; staminate catkins ovate or subglobose, 1 to 2 lines long, borne at the ends of the ultimate branchlets; ovulate catkins greenish, composed of about 7 pairs of broadly ovate thinnish scales; cones dull brown, broadly oblong or subglobose, 1 to 2 inches long; scales flat-topped, with a central curved thin-edged ridge-like umbo; seeds 1 to 2 lines long, narrowly wing-margined but irregularly shaped from crowding in the cones and with a minute white lanceolate attachment scar at base.

Two groves on sea coast near Monterey. The Point Cypress Grove extends from Point Cypress south about two miles to Pescadero Point at Carmel Bay, occupying a strip a few hundred yards wide or with a few trees scattered farther inland. The Point Lobos Grove occurs on Point Lobos south of Carmel Bay. Many trees stand on the bold headlands or cling to the rocky sea-cliffs and are carved into picturesque outlines by the violent winds from the Pacific. The flattened or board-like stems are a characteristic feature of these trees. Monterey Cypress is cultivated in many parts of the world and is highly valued as a windbreak in California since it is of rapid growth and affords a perfect shelter.

Refs.—CUPRESSUS MACROCARPA Hartweg in Gordon, Jour. Hort. Soc. Lond. vol. 4, p. 296, fig (1849), vol. 2, p. 187 (1847); Hooker, Gard. Chron. 1885, p. 176, fig.

3. *C. sargentii* Jepson n. nom. SARGENT CYPRESS. Shrub or small tree with compact crown, 8 to 15 feet high; bark grayish brown and fibrous; leaves with a closed dorsal pit, rarely with lateral depressions, about $\frac{1}{2}$ line long; cones globose, often congested in heavy clusters, shortly peduncled, 8 to 11 lines in diameter; scales 6 or 8, with a very small low upwardly impressed crescent-shaped umbo; seeds brown, acutely margined, $1\frac{1}{2}$ to 2 lines long.—(*Frutex vel arbor parva* 8 ad 15 ped. alta; cortex cinereofuscus fibratusque; folia circa $\frac{1}{2}$ lin. longa cum alveolis dorsuali clauso, infrequenter cum cavis lateralibus; coni globosi saepe valde aggregati, breviter pedunculi, 8 and 10 lin. in diametro; squamæ 6 ad 8 cum umbone paululo, brevi, lunato atque de infra impresso; semina fusca acute marginata $1\frac{1}{2}$ ad 2 lin. longa).

Dry mountain slopes: Mayacamas Range, W.L.J. no. 3027 (type); west side Mt. Tamalpais; Cedar Mt., Alameda Co.; Bonny Doon, Santa Cruz Mts.; Los Burros Trail, Santa Lucia Mts. Localities few and isolated.

Refs.—*CUPRESSUS SARGENTII* Jepson. *C. goveniana* Engelmann in Bot. Cal. vol. 2, p. 114, exclusive of Monterey plants; Sargent, Silva N. Am. vol. 10, p. 107, t. 527 (1896); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

4. *C. macnabiana* Murr. McNAB CYPRESS. Shrub or tree most commonly 15 to 25 but even 40 feet high with trunk $\frac{1}{4}$ to nearly 2 feet in diameter; bark light gray and very smooth; foliage pungently fragrant with a spicy odor; leaves $\frac{1}{2}$ line long with a conspicuous resin pit or white gland on the back towards the apex, often slightly glaucous; cones globose, clustered, short-peduncled, 5 to 8 lines in diameter, reddish or grayish brown; scales 6 to 8 with strong conical umbos, the uppermost pair very prominent or horn-like and incurved; seeds brown, $1\frac{1}{2}$ to mostly 2 lines long.

Samuels Springs (Napa Co.) to Coyote Valley; Red Mt., Bartlett Creek and northward to Whiskeytown, Shasta Co. (type loc.), and near Dobbin and Magalia in northern Sierra foothills.

Refs.—*CUPRESSUS MACNABIANA* Murray, Edin. New Phil. Jour. vol. i, p. 293, pl. 11 (1855); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

5. *C. bakerii* Jepson n. sp. MODOC CYPRESS. Shrub or becoming a small tree 25 feet high with red-brown bark and very slender branchlets; leaves with a distinct resin pit on middle of keeled back; staminate catkins 1 line long or less; cones globose, satiny or glaucous, 5 to 6 lines in diameter; scales 3 pair or with a fourth smaller upper pair; umbos abruptly drawn to a short point, either nipple-like or compressed, straight or slightly curved; seeds brown, $1\frac{1}{2}$ lines long, narrowly wing-margined.—(*Frutex vel arbor parva* 25 ped. alta; cortex rufo-fuscus; ramusculi tenuissimi; folia glandula distincta resiniferaque in medio carinato dorso; amenta staminata 1 lin. vel minus longa; coni globosi, nitidi vel glauci, 4 ad 6 lin. in diametro; tria paria squamarum vel quartum par minor supra; umbones abrupte contracti ad apicem vel papillati vel compressi, recti vel leniter unci; semina fusca $1\frac{1}{2}$ lin. longa, anguste marginata ala).

Lava beds of southeastern Siskiyou and southwestern Modoc cos. Between Little Hot Spring Valley and Hills Farm, it is associated with Juniper, Yellow Pine and Knob-cone Pine (M. S. Baker).

5. JUNIPERUS L. JUNIPER.

Trees or shrubs. Leaves in whorls of 3 or opposite, scale-like, imbricated, closely appressed and adnate to the branchlets or linear-subulate and spreading. Stamens and ovules on separate trees. Staminate catkins with many

stamens, each with 2 to 6 pollen-sacs. Ovulate catkins of 3 to 6 succulent coalescent scales, each bearing 1 or 2 ovules. Cones fleshy and berry-like, ripening the second year, in ours 1 to 3-seeded; cotyledons 2 to 6.—Northern hemisphere, about 30 species. (Ancient Latin name.)

Catkins axillary; leaves linear-subulate, spreading, white-glaucous above; subalpine shrub.

.....1. *J. communis*.

Catkins terminal on short branchlets; leaves scale-like, closely appressed to the branchlets, in whorls of 3 or opposite.

Berries reddish brown, oblong; cotyledons 4 to 6; medium altitudes, chiefly Coast Ranges.

.....2. *J. californica*.

Berries blue-black, globose or subglobose.

Cotyledons 4 to 6; desert ranges.....3. *J. utahensis*.

Cotyledons 2; high Sierras4. *J. occidentalis*.

1. ***J. communis* L. DWARF JUNIPER.** Low or prostrate alpine shrub, 1 foot high or less, forming patches a few feet in diameter; leaves rigid, linear or lanceolate, acute, cuspidate, 3 to 6 lines long, 3 (rarely 2) at a node with very short internodes, spreading or ascending, green below, white-glaucous above; staminate catkins $1\frac{1}{2}$ to $2\frac{1}{4}$ lines long, their scales broad and abruptly contracted into a short subulate point; berries globose, bright blue, covered with white bloom, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines long.

Sierra Nevada, 8,000 to 10,000 feet, from Mono Pass north to Mt. Shasta, and west to Trinity Co. Widely distributed in the United States in the high mountains, ranging far north to Alaska and Greenland, and in the Old World.

Ref.—*JUNIPERUS COMMUNIS* Linnaeus, Sp. Pl. 1040 (1753).

2. ***J. californica* Carr. CALIFORNIA JUNIPER.** Usually a shrub, much-branched from the base, 2 to 20 feet high, or occasionally a tree 40 feet in height; bark brown or ashen gray, the thin outer layers becoming at length very loose and shreddy; leaves in 3s, ovate, acute, each with a dorsal pit towards the base, crowded on the ultimate branchlets or occasionally free and subulate, $\frac{1}{2}$ to 1 line long; ovulate catkins consisting of 4 to 6 scales; berries reddish or brownish, almost smooth or roughened with a few small projections or horn-like processes, covered with a dense white bloom, subglobose or oblong, 4 to 7 lines long, with dry fibrous sweet flesh and 1 to 3 seeds; seeds ovate, acute, brown with a thick smooth but angled or ridged polished bony shell, 3 to $5\frac{1}{2}$ lines long; embryo $2\frac{1}{3}$ lines long with 4 to 6 cotyledons.

Dry hills or arid mountain slopes; North Coast Ranges from Mt. St. Johns southwesterly to the hill country west of Scott Valley, Lake Co. (Carl Purdy); South Coast Ranges from Mt. Diablo along the Mt. Hamilton Range to Tres Pinos, San Carlos Range and Priest Valley, southward to Matilija Creek, eastward to Fort Tejon and thence northward in the Sierra Nevada to Kernville and the Merced River (type loc., 1,000 feet altitude). Abundant on desert slopes of Sierra Madre and San Bernardino Mts. and southward into Lower California. Attributed to the "Lower Sacramento" in the Botany of the California where it does not exist, but the reference has been copied by many later authors.

Refs.—*JUNIPERUS CALIFORNICA* Carriere, Rev. Hort. 1854, p. 352, fig.; Palmer, Am. Nat. vol. 12, p. 593 (1878); Jepson, Fl. W. Mid. Cal. p. 25 (1901).

3. ***J. utahensis* Lemmon. DESERT JUNIPER.** Small or stunted shrub 3 to 15 (or 20) feet high; very similar to the preceding, but distinguishable by its more slender branches, its usually glandless leaves which are acute and sometimes in whorls of 2, and its usually globose 1-seeded berries; berries

blue-black with a whitish bloom and 4 to 5 lines long, resembling the next but the cotyledons 4 to 6.

Desert ranges of California east of the Sierra Nevada: White and Inyo mts., Panamint Range, Grapevine and Providence mts., and north to Virginia City. Widely distributed in Nevada, Arizona and Utah.

Refs.—*JUNIPERUS UTAHENSIS* Lemmon, Rep. Cal. Board For. vol. 3, p. 183, t. 28, fig. 2 (1890). *J. californica* var. *utahensis* Engelmann, Trans. St. Louis Acad. vol. 3, p. 588 (1877); Watson, Bot. Cal. vol. 2, p. 113 (1880).

4. **J. occidentalis** Hook. SIERRA JUNIPER. Subalpine tree 10 to 25 or sometimes 65 feet high; trunk 1 to 5 feet in diameter, the bark dull red, flaking off in thin scales or shreds; branchlets alternate, the ultimate ones small, numerous, congested; leaves in 3s, $\frac{1}{2}$ line long, ovate-triangular, bearing on the back a more or less distinct gland or pit, or on vigorous shoots subulate and 1 to 2 lines long; staminate catkins $1\frac{1}{2}$ to 2 lines long, 6 pollen-sacs under each peltate scale; berries globose to ovoid, blue-black with a whitish bloom, 3 to 5 lines long, almost smooth or minutely umbonate, with resinous juicy flesh and 2 seeds (rarely 1 or 3); seeds flat on the face, the convex back with 3 to 5 resinous-glandular pits; embryo $\frac{3}{4}$ to 1 line long, with 2 cotyledons.

Timber line tree in Sierra Nevada, 6,000 to 10,000 feet in southern part and 3,500 to 7,000 feet in northern part, occurring as scattered individuals or in open groves, often found on the bare granite; trunks tapering strongly upward. Ranges south to San Bernardino Mts. and San Pedro Martir, north to Mt. Shasta, thence west to Trinity Mts. and south to South Yollo Bolly (W.L.J., 1897). Extends north through eastern Oregon to Idaho.

Refs.—*JUNIPERUS OCCIDENTALIS* Hooker, Fl. Bor. Am. vol. 2, p. 166 (1839), type loc. Columbia River basin, Douglas; Muir, Mts. of Cal. p. 204 (1901).

TAXACEAE. YEW FAMILY.

Trees or shrubs with linear flat 2-ranked leaves. Staminate and ovulate organs on different trees. Stamen clusters arising from axillary buds on under side of branchlets, the filaments monadelphous in a column. Ovules solitary and terminal on the branchlets. Seed with a bony coat, set in a fleshy disk or completely enveloped by it. Embryo small, embedded in abundant endosperm; cotyledons 2.

Fruit scarlet; stamens 8 to 12 in a cluster; leaves $\frac{1}{2}$ to $\frac{3}{8}$ inch long, acute at apex, without resin-canal1. *TAXUS*.

Fruit green or purplish; stamens 24 to 32 in a cluster; leaves $1\frac{1}{4}$ to $2\frac{1}{2}$ inches long, stiffish, bristle-pointed, the resin-canal central2. *TORREYA*.

1. *TAXUS* L. YEW.

Trees or shrubs with leaves bluntnish or merely acute. Stamens 8 to 12 in a cluster, the 4 to 9 pollen-sacs borne under a shield-like crest. Ovule seated upon a circular disk which in fruit becomes cup-shaped, fleshy and red, surrounding the bony seed, the whole berry-like.—Northern hemisphere, 1 species and 6 subspecies. (Ancient Latin name of the yew.)

1. **T. brevifolia** Nutt. WESTERN YEW. Small tree 15 to 30 feet high, rarely exceeding 40 feet, irregular in outline, the branches of unequal length and standing at various angles but tending to droop; trunk $\frac{1}{2}$ to 2 feet in diameter, with a thin red-brown smooth bark which becomes shreddy as it flakes off in thin and rather small pieces; leaves linear, acute at apex, shortly petioled, flat with midrib in relief above and below, 3 or mostly 6 to 8 lines

long, 1 line wide, spreading right and left in flat sprays; stamen clusters globose, 1 to $1\frac{1}{2}$ lines long; seeds borne on the under side of the sprays and when mature set in a fleshy scarlet cup, the whole looking like a brilliantly colored berry, 5 or 6 lines long.

Along deep cañon streams or moist shady bottoms: Sierra Nevada from Lassen Peak southward to Tulare Co.; cañons below south base of Mt. Shasta; north Coast Ranges (chiefly between 1,000 and 2,500 feet) from the Klamath Range and the Siskiyou Mts. south to Three Creeks (Humboldt Co.), Sherwood, Snow Mt. and Mt. St. Helena; Santa Cruz Mts., Laguna Creek (Dr. C. L. Anderson). Reported in the Santa Lucia Mts. but no definite locality on record. Its general range in California is essentially that of Douglas Fir but it occurs only in widely sundered localities of very small area and is not abundant in any locality. Beyond our borders ranging north to southern tip of Alaska and eastward to the continental divide in western Montana. Wood very hard, dense, springy and durable; used for machine bearings and by the native tribes for their best bows.

Refs.—*TAXUS BREVIFOLIA* Nuttall, *Sylva*, vol. 3, p. 86, t. 108 (1849), type loc. near mouth of Columbia River, *Nuttall*; Jepson, *Fl. W. Mid. Cal.* p. 17 (1901); Goddard, *Univ. Cal. Publ. Am. Archae.* vol. 1, p. 32 (1903).

2. **TORREYA** Arn.

Trees with rigid sharp-pointed leaves. Stamen clusters solitary in the adjacent leaf axils, borne on 1-year-old branches, made up of 6 to 8 whorls of stamens, 4 stamens in a whorl, each filament with 4 pollen-sacs without erests. Ovule completely covered by a fleshy aril-like coat, the whole becoming drupe-like in fruit. Seed with thick woody outer coat, its inner layer irregularly folded into the white endosperm.—Four species, 1 in California, 1 in Florida, and 2 in China and Japan. (Named for John Torrey of Columbia College, long identified with western botany and who first visited California before the days of the Overland Railroad.)

1. **T. californica** Torr. CALIFORNIA NUTMEG. Handsome dark green tree 15 to 90 feet high, the trunk $\frac{1}{2}$ to 3 feet in diameter and clothed in smoothish thin dark bark; leaves rigid, $\frac{1}{4}$ to $2\frac{1}{2}$ inches long, $1\frac{1}{2}$ lines wide, flat, dark green above, yellowish green beneath and with two longitudinal glaucous grooves, linear or somewhat tapering upward, the apex armed with a stout short bristle, twisted on their short petioles so as to form a 2-ranked flat spray; stamen clusters whitish, globose, about 3 lines long, crowded on the under side of the branches; fruit elliptical in outline, resembling a plum or olive, green in color or when ripe streaked with purple, $1\frac{1}{8}$ to $1\frac{3}{4}$ inches long; flesh thin and resinous; shell of the seed more or less longitudinally grooved; embryo minute (1 line long), placed at the upper end of the seed; endosperm copious, with irregular incisions filled by the inner coat, giving it a marbled appearance so that in cross-section the seed resembles the true nutmeg of commerce.

Coast Ranges: Big River and Melburne, Mendocino Co.; Bartlett Springs: Mayacamas Range from the Terraces east of Ukiah south to Mt. St. Helena; Duncans Mills; Bolinas Ridge from Toaloma to Mt. Tamalpais; Santa Cruz Mts. from La Honda to Arribald Creek (W.L.J.) and southeasterly to Hume, Norton and Saratoga cañons between 1,000 and 2,000 feet (R. L. Pendleton). Sierra Nevada: Lassens Butte, Yuba and Feather rivers, and reported from

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